02-Introduction to C++

principles of programming

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C++

- C++ is a middle-level programming language
- Developed by Bjarne Stroustrup
- Starting in 1979 at Bell Labs
- C++ runs on a variety of platforms
  - Windows,
  - Mac OS,
  - various versions of UNIX
- Designed with a bias toward system programming and embedded

C++

A Programming Language

- General-purpose programming language
- Features
  - Object-oriented & generic programming features
  - Low-level memory manipulation
- Consists of
  - Key words
  - Syntax
  - Semantics

C++ Vs Natural Languages

- C++
  - Artificial Language
  - Consist of
    - Keywords
    - Syntax
  - Translate through the Compilers
- Natural Language
  - Natural
  - Consist of
    - Words
    - Syntax
  - Translate trough the Machine Translation systems or Human

Key words/ words

C++ •

·11)	else	requ
·11)	enum	retu
	explicit	sho
	export(1)	sig
	extern	siz
	false	sta
	float	sta
	for	sta
	friend	str
	goto	swi
	if	tem
	inline	thi
	int	thr
·+11)	long	thr
·+11)	mutable	tru
	namespace	try
	new	typ
'S)	noexcept (since C++11)	typ
	not	typ

Natural Language •

Nouns	Verbs	
book	drive	d
park	wash	
clock	sleep	
dog	skate	
Molly	hide	
cookies	eat	
car	wave	
tree	play	
pen	work	a
book	hop	

Syntax

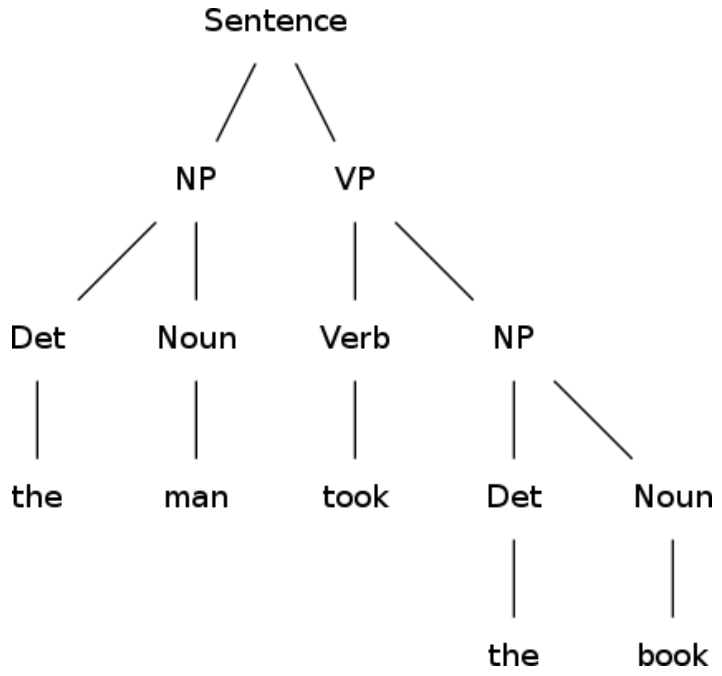
- C++

Rules for construction of valid statements, including, Order of words, Punctuation

```
#include <iostream>
using namespace std
void swap()
{
    cout<<"this is
}
int main()
{
    int firstNum , 
    cout<<"Enter va
    cin>>firstNum;
    cout<<"Enter va
    cin>>secondNum;
```

- Natural Language

Grammar rules, subject, object, verbs etc.



Minimum C++ Program

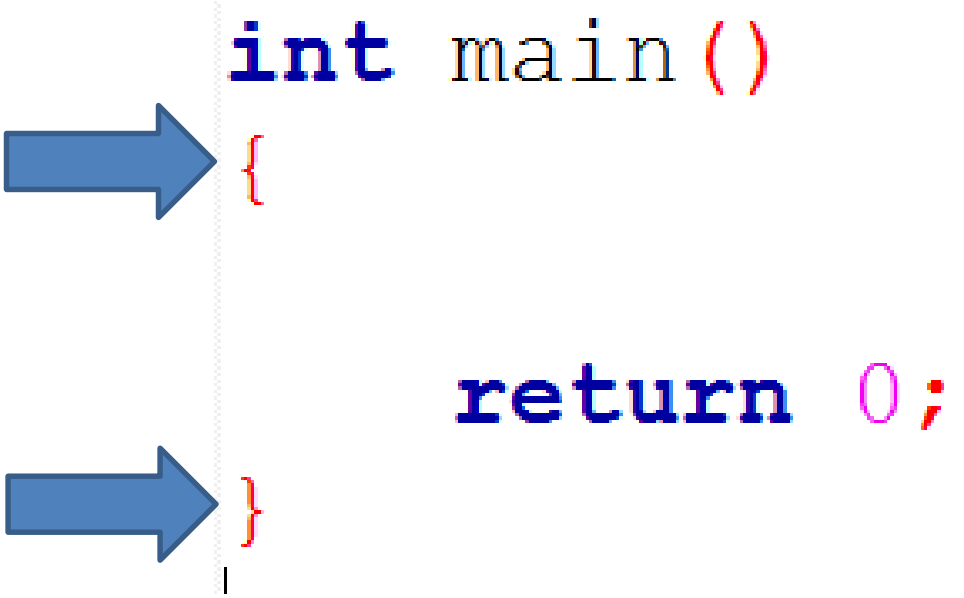
- Do nothing

```
int main()
{

    return 0;
}
```

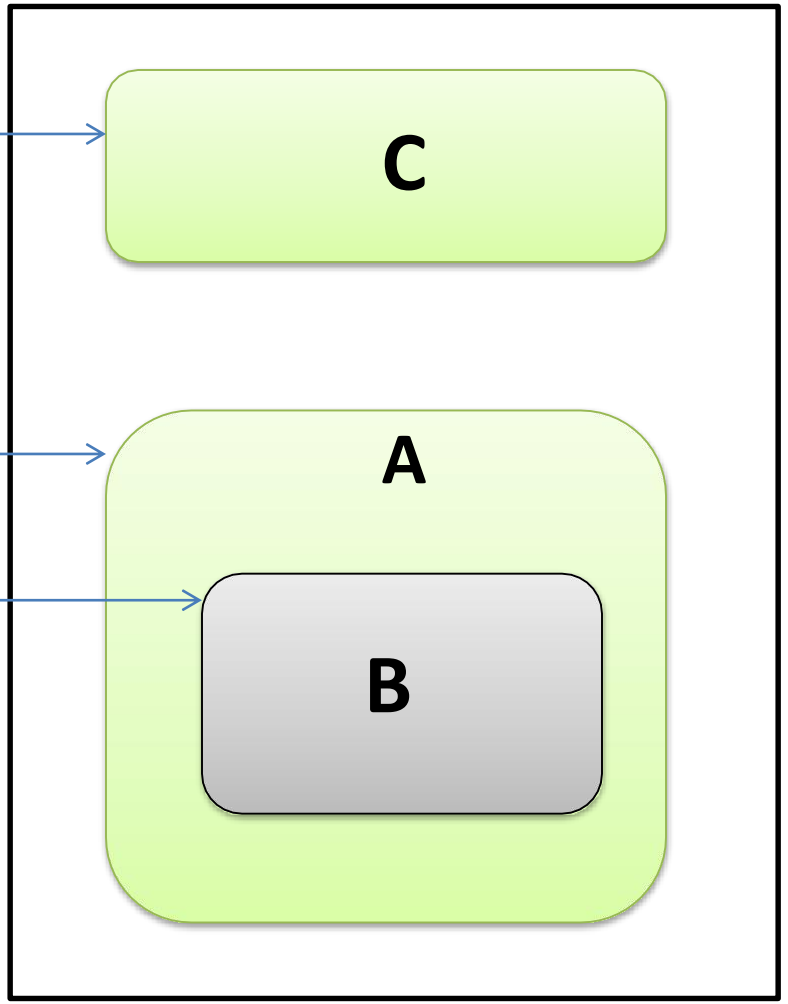
C++ Block

A block is a set of logically connected statements that are surrounded by opening and closing braces.



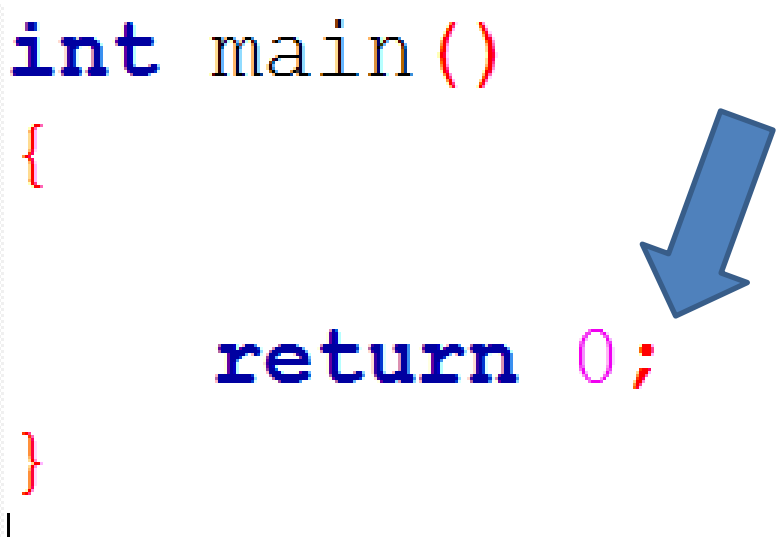
Blocks

```
void message()
{
    //C
}
int main()
{
    // A
    {
    //   B
    }
     return 0;
}
```



C++ semicolon

The **semicolon** is a statement terminator. That is, each individual statement must be ended with a semicolon.



Template for a C++ Program

```
#include <iostream>

using namespace std;

int main() {

        program statements

}
```

Example

Create a C++ program to print message on console window

```
//My first C++ program
#include <iostream>

using namespace std;

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

Example

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

- This is a **comment** line.
- All lines beginning with two slash signs (//) or (/*) are considered comments and do not have any effect on the behavior of the program.
- // Single line comment
- /* */ block comment

Example

```
#include <iostream>
```

- Lines beginning with a hash sign (#) are directives for the preprocessor.
- They are indications for the compiler's preprocessor.
- In this case the directive **#include <iostream>** tells the preprocessor to include the iostream standard file.

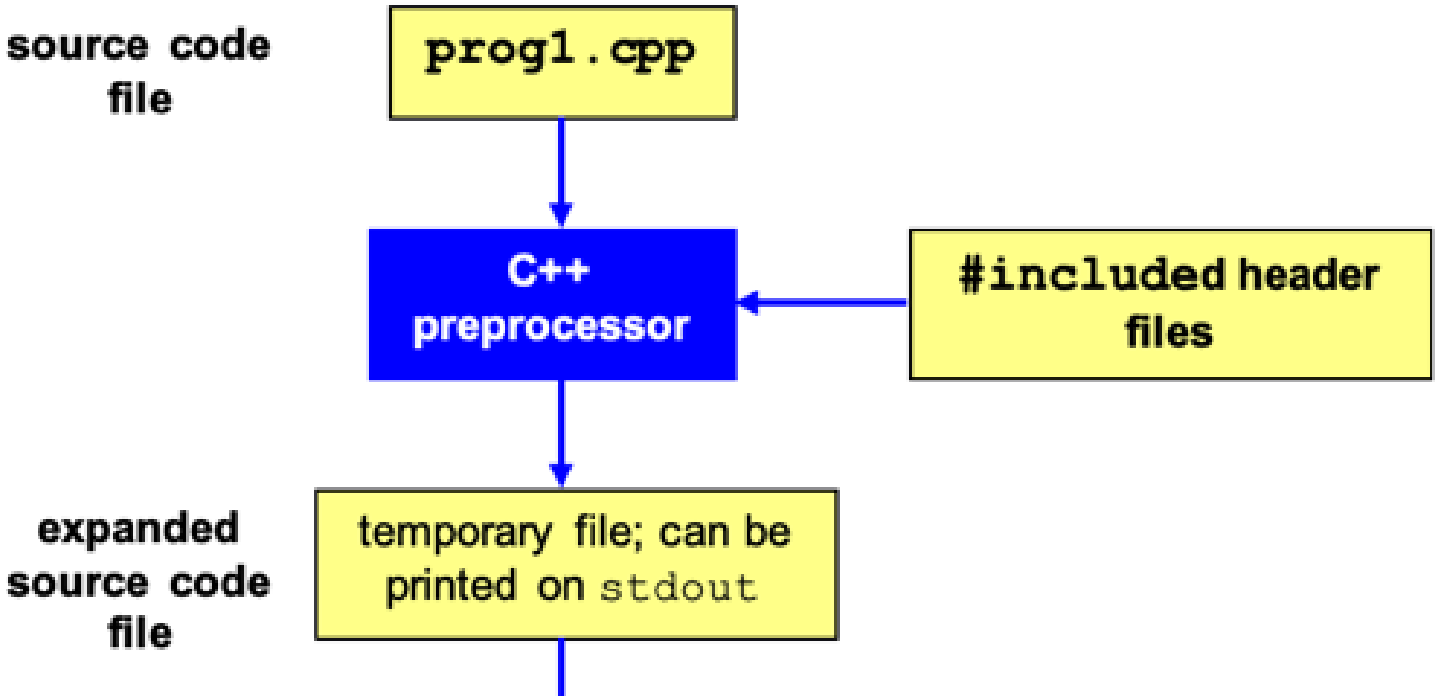
- This specific file (**iostream**) includes the declarations of the basic standard input-output library in C++ , **like cin, cout, cerr, etc.** , and it is included because its functionality is going to be used later in the program.

What is preprocessor.

- The preprocessor provides the ability for the **inclusion of header files**.

- When the C++ preprocessor encounters the #include <file> directive, it replaces it with the content of the file creating an expanded source code file

Preprocessor



Example

```
using namespace std;
```

- All the elements of the standard C++ library are declared within what is called a **namespace**, the namespace with the name **std**

The Standard Template Library (STL) is a set of C++ template classes to provide common programming data structures and functions such as lists, stacks, arrays, etc. It is a library of container classes, algorithms, and iterators

main function

```
int main()
{

    return 0;
}
```

```
void main()
{


}
```

- The main function is the point by where all C++ programs start their execution, independently of its location within the source code.
- **All C++ programs have a main function**

C++ Output (Print)

```
cout << "Hello world!";
```

The cout object, together with the << operator, is used to output values/print to the screen.

You can add as many cout objects as you want.

```
void main()
{
  cout << "Hello World!";
  cout << "I am learning C++";
}
```

```
Hello World!I am learning C++
```

Return statement

```
return 0;
```

- The return statement causes the main function to finish.

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

Example

- Create a C++ program to display your name and address

```
void main()
{
   cout << "Mohammed Hassan";
   cout << "Mukalla , Hadramout";
}
```

```
Mohammed Hassan Mukalla , Hadramout
```

New Line

```
endl;
```

```
void main()
{
   cout << "Mohammed Hassan "<< endl;
   cout << "Mukalla , Hadramout";
}
```

```
Mohammed Hassan
Mukalla , Hadramout
```

New Line "\n"

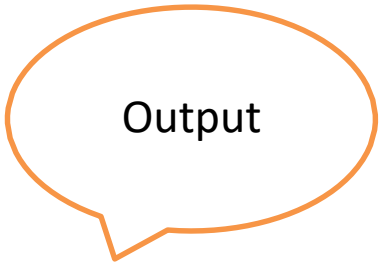
```
void main()
{
  cout << "Mohammed Hassan "<< "\n";
  cout << "Mukalla , Hadramout";
}
```

```
Mohammed Hassan
Mukalla , Hadramout
```

Example 2

- What is output of the following program

```
int main()
{
    cout << "C:\WINDOWS is Windows's root directory";
    return 0;
}
```




```
C:WINDOWS is Windows's root directory
```

Escape sequences

- **Escape sequences** are used to represent certain special characters within string literals (“ ”)

Escape sequence	Description
\'	single quote
\"	double quote
\?	question mark
\\	backslash
\a	audible bell
\b	backspace
\f	form feed - new page
\n	line feed - new line
\r	carriage return
\t	horizontal tab

Exercise

Write a C++ Program to Display the Following output1.

```
------------------------------

C1033
Fundamentals of Programming

- - - - - - - - - - - - - - - - - - - - - - - -
```

Different ways to create a C++ program

```
#include <iostream>

using namespace std;

int main() {
    cout << "This is a simple C++ program!" << endl;
}
```

```
#include <iostream>

int main() {
    std::cout << "This is a simple C++ program!" << std::endl;
}
```

Different ways to create a C++program

```
#include <iostream>

using std::cout;
using std::endl;

int main() {
    cout << "This is a simple C++ program!" << endl;
}
```

Different ways to create a C++program

```
#include <iostream>

using namespace std;

int main() {
    cout << "    *    " << endl;
    cout << "   ***   " << endl;
    cout << "  *****  " << endl;
    cout << "    *    " << endl;
    cout << "    *    " << endl;
    cout << "    *    " << endl;
}
```

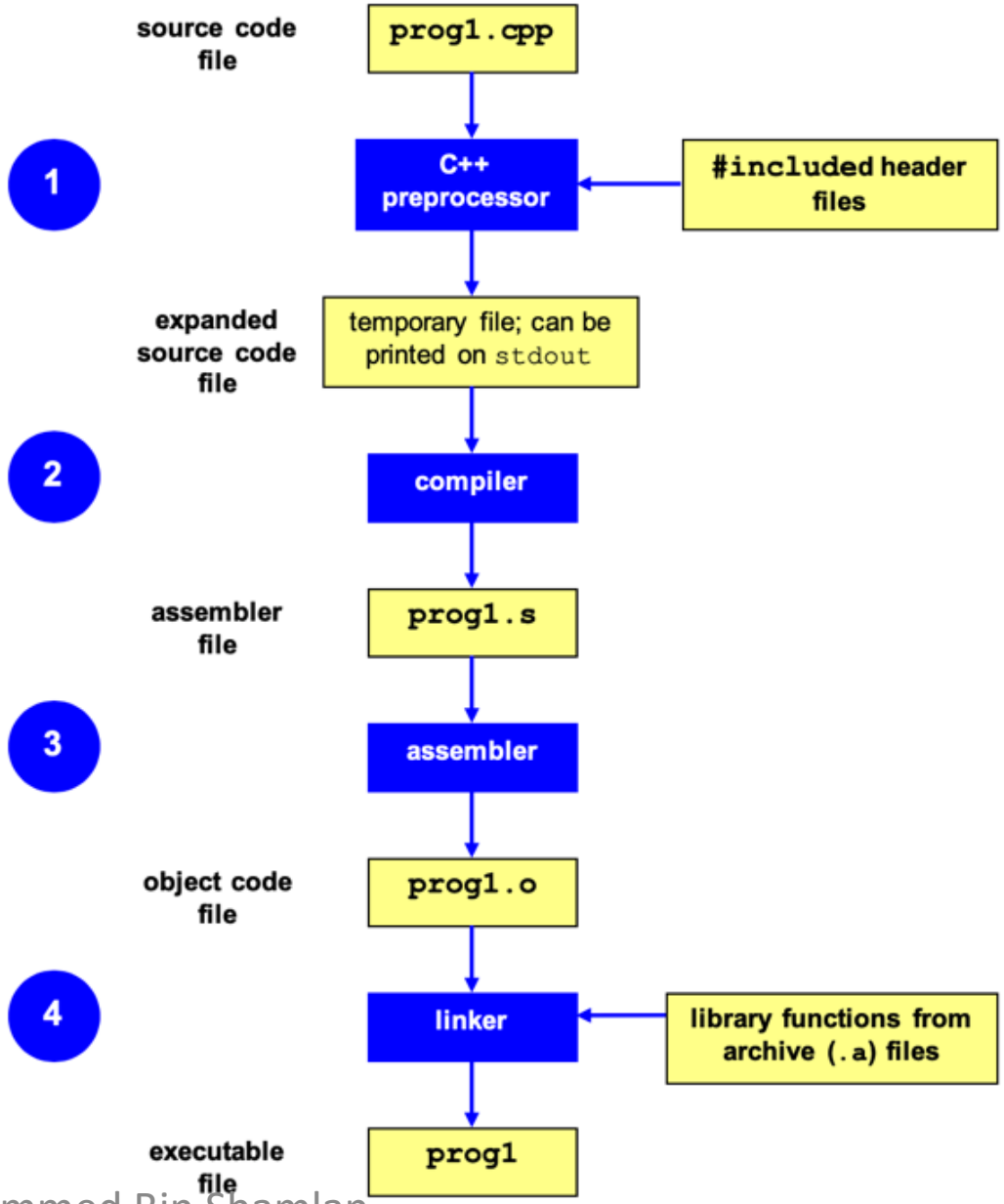
Different ways to create a C++program

```
#include <iostream>

using namespace std;

int main() {
    cout << "    *    " << endl
         << "   ***   " << endl
         << "  *****  " << endl
         << "    *    " << endl
         << "    *    " << endl
         << "    *    " << endl;
}
```

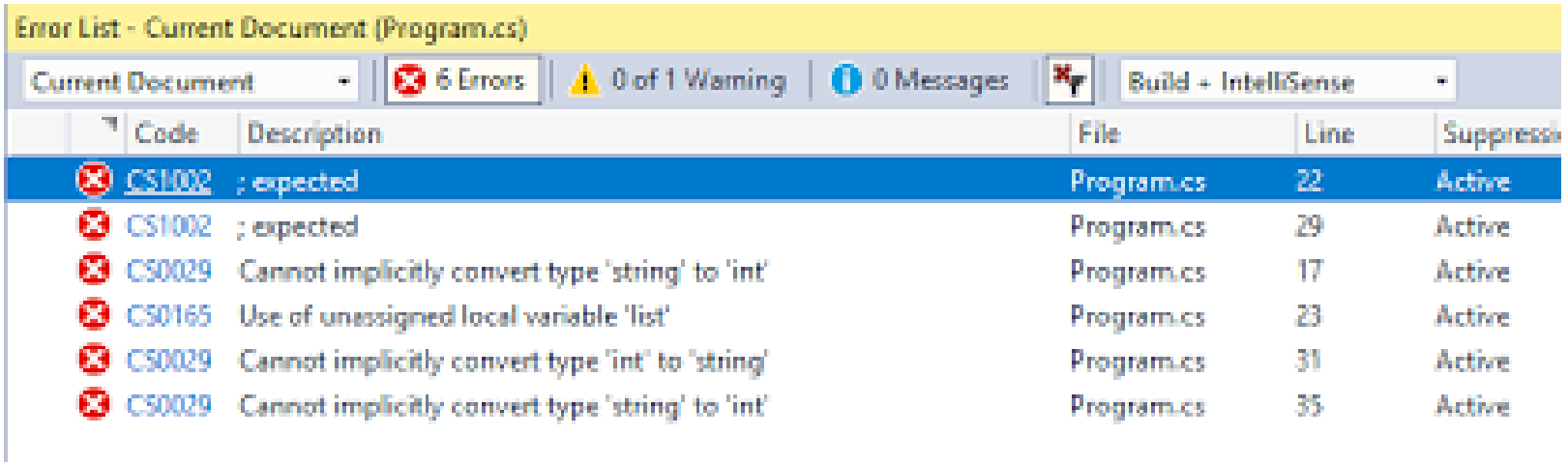
Compiling


source code file
prog1.cpp
1
C++ preprocessor
#included header files
expanded source code file
temporary file; can be printed on stdout
2
compiler
assembler file
prog1.s
3
assembler
object code file
prog1.o
4
linker
library functions from archive (.a) files
executable file
prog1

Compile errors

Compilation Errors

- Compiler **fails to compile** a piece of computer program source code.
- Error message is given



Common C++ compilation errors

- Undeclared identifier
- Common function undeclared
- = expected
- Internal compiler error
- Unexpected closing brace

```
error: expected ';' before 'int'
In function 'int main()':
error: 'cout' was not declared in this scope
error: expected ';' before 'cout'
error: return-statement with no value, in function returning 'int' [-fpermissive]
```

Example

- Write the following C++ program and identify Compilation errors

```
#include <istream>

using namespace std

int main()
{
    cout << "Department of Computer Science" << endl
    cout << KDU;

    return ;
}
```

Example

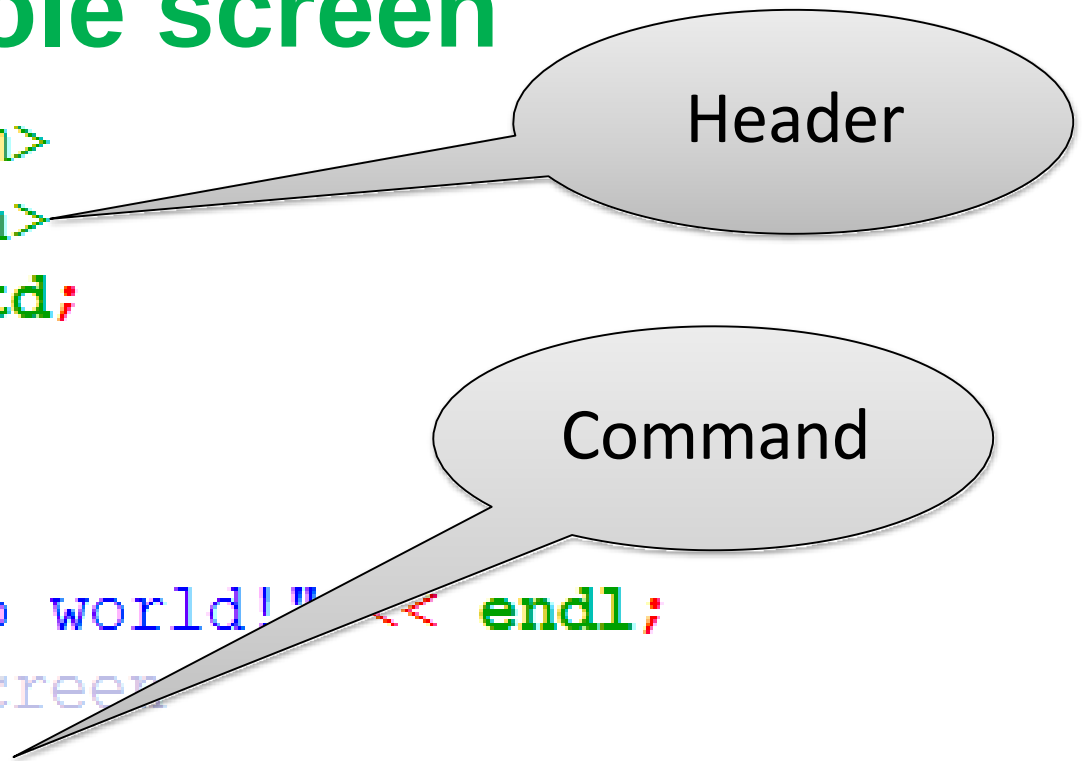
- Correct errors and rewrite the program

Clear the console screen

```
#include <iostream>
#include <stdlib.h>
using namespace std;

int main()
{
    cout << "Hello world!" << endl;
    //Clear the screen
    system("cls");
    cout << "New screen";

    return 0;
}
```



Change console Text and background color

- Sets the default console foreground and background colours.
- Syntax
  - COLOR [background][foreg
  - system("Color FA");
  - system("Color F0");

```
#include <stdlib.h>
```

Below is the table for allow color in C++:

Color id	Color	Color id	Color
1	Blue	9	Light Blue
2	Green	0	Black
3	Aqua	A	Light Green
4	Red	B	Light Aqua
5	Purple	C	Light Red
6	Yellow	D	Light Purple
7	White	E	Light Yellow
8	Gray	F	Bright White

```cpp
// C++ program to illustrate coloring
#include <iostream>
#include <windows.h>
using namespace std;

// Driver Code
int main()
{
    // 0 for background Color(Black)
    // A for text color(Green)
    system("Color 0A");

    // Print any message
    cout << "Geeks For Geeks!";
    return 0;
}
```

Color Code

- 0 = Black
- 1 = Blue
- 2 = Green
- 3 = Aqua
- 4 = Red
- 5 = Purple
- 6 = Yellow
- 7 = White
- 8 = Gray
- 9 = Light Blue
- A = Light Green
- B = Light Aqua
- C = Light Red
- D = Light Purple
- E = Light Yellow
- F = Bright White

Example

- Write a C++ program to display following screen

```
USER INFORMATION

----------------------------

NAME    : B. HETTIGE

ADDRESS: No23, Panadura

AGE     : 19

SALARY  : 23500

GENDER  : M

----------------------------
```

Summary

- C++ Programming Language?
- C++ Vs Natural Languages
- C++ Syntax
- Create a C++ program using code:blocks
- Cording styles
- Handle compile errors
- Customize Console screen