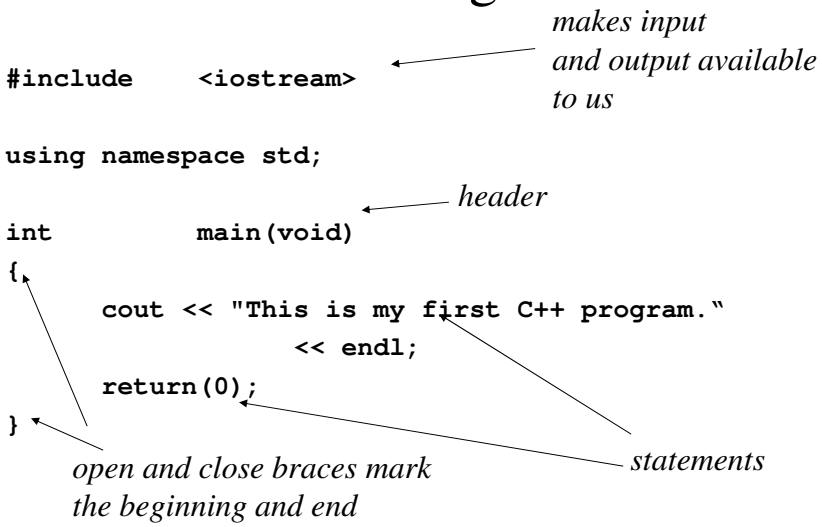
CSC 270 – Survey of Programming Languages

C++ Lecture 1 : C++ As A Better C

A First Program




```
#include    <iostream>

using namespace std;

int         main(void)
{
      cout << "This is my first C++ program."
                  << endl;
      return(0);
}
```

Average3.cpp

```
#include    <iostream>

using namespace std;

int         main(void)
{
      int         value1, value2, value3;
      float sum, average;

      cout << "What is the first value? ";
      cin >> value1; // for comments

      cout << "What is the second value? ";
      cin >> value2;
```

```
      cout << "What is the third value? ";
      cin >> value3;

      sum = value1 + value2 + value3;
      average = sum / 3;

      cout << "Average = " << average << endl;
      return(0);
}
```

Comments

- Our program is a bit longer than our previous programs and if we did not know how to calculate gross pay, we might not be able to determine this from the program alone.
- It is helpful as programs get much longer to be able to insert text that explains how the program works. These are called ***comments***. Comments are meant for the human reader, not for the computer.
- In C++, anything on a line after a double slash (**//**) is considered a comment.

A program that uses a character variable

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

// A very polite program that greets you by name
int    main(void)
{
       string name;

       cout << "What is your name?\t";
       cin >> name;

       cout << "Pleased to meet you, " << name << endl;
       return (0);
}
```

Formatting **`float`** output in C++

- `cout` and `cin` are examples of what are called stream input/output.
- Stream I/O uses a set of built-in values called ***format flags*** to determine how data is printed. We can changes these values by using **`setf()`**. For now, we will use it only to reformat float values.

`setf` and the `ios` flags

- When we wish to ensure that float is printed with a fixed decimal point and a certain number of decimal places we place:

```
cout.setf(ios::showpoint);
cout.setf(ios::fixed);
cout.precision(2);
```

Gives us two decimal places

*Float numbers are always written in regular notation (**not** **scientific notation**)*

Guarantees that trailing zeros appear

the `width` flag

- Every time we wish a number to be printed and to take up a fixed amount of place (not merely what it needs), we write:

  ```
  cout.width(15);
  ```

  This assures that the item being printed will occupy 15 spaces.
- Unlike the other flags changes that remain in effect once you call them, width must be reset each time you use it.

Changing the width

Number	Formatting	Print as:
182	`cout.width(2)`	182
182	`cout.width(3)`	182
182	`cout.width(5)`	``182
182	`cout.width(7)`	``182
-182	`cout.width(4)`	-182
-182	`cout.width(5)`	`-182
-182	`cout.width(7)`	```-182

Changing the width (continued)

Number	Formatting	Print as:
23	cout.width(1)	23
23	cout.width(2)	23
23	cout.width(6)	….23
23	cout.width(8)	……23
11023	cout.width(4)	11023
11023	cout.width(6)	.11023
-11023	cout.width(6)	-11023
-11023	cout.width(10)	…..11023

Changing the precision

Number	Width	Precision	Prints as:
2.718281818	cout.width(8)	cout.precision(5);	`2.71828
2.718281818	cout.width(8)	cout.precision(3);	```2.718
2.718281818	cout.width(8)	cout.precision(2);	````2.72
2.718281818	cout.width(8)	cout.precision(0);	````````3
2.718281818	cout.width(13)	cout.precision(11);	2.71828182800
2.718281818	cout.width(12)	cout.precision(11);	2.71828182800

The revised *Compound* program

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

//    Calculate the interest that the Canarsie
//    Indians could have accrued if they had
//    deposited the $24 in an bank account at
//    5% interest.
int   main(void)
{
      const int   present = 2000;
      int         year;
      const float rate = 0.05;
      float       interest, principle;

      //    Set the initial principle at $24
      principle = 24;
```

```
      // For every year since 1625, add 5%
      //    interest to the principle and print
      //    out the principle

      //There has to be two fixed places for
      //    the principle
      cout.setf(ios::showpoint);
      cout.setf(ios::fixed);
      cout.precision(2);
```

```
      for  (year = 1625;  year < present;  year++)    {
            interest = rate * principle;
            principle = principle + interest;

            cout << "year = " << year ;

            // Use 15 places for printing the principle
            cout << "\tprinciple = ";
            cout.width(15);
            cout << principle << endl;
      }
      return(0);
}
```

exit()

- **exit()** allows the user to let a program terminate if the program detects an unrecoverable error.
- The statement

  #include <cstdlib>

  has to be included.
- A non-zero status value should be returned when the program terminates abnormally.

What Are References Parameters?

- Reference parameters do not copy the value of the parameter.
- Instead, they give the function being called a copy of the address at which the data is stored. This way, the function works with the original data.
- We call this ***passing by reference*** because we are making references to the parameters.

Rewriting `power`

- We can make the **`power`** function tell the main program about the change in y by placing am ampersand (**`&`**) between the data type and variable name:

```
void power (float &y, float x, int n)
{
… … …
}
```

power.cpp rewritten

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

void power(float &y, float x, int n);

// A program to calculate 4-cubed using a
// function called power
int main(void)  {
  float     x, y;
  int n;

  x = 4.0;
  n = 3;
  y = 1.0;
  power(y, x, n);
  cout << "The answer is " << y << endl;
}
```

```
// power() -  Calculates y = x to the nth power
void power(float &y, float x, int n)  {
  y = 1.0;
  while (n > 0) {
    y = y * x;
    n = n - 1;
  }
  cout << "Our result is " << y << endl;
}
```

```
// Find the average of three numbers using a
// function
int main(void)  {
  int value1, value2, value3;
  float mean;

  //Get the inputs
  getvalue(value1);
  getvalue(value2);
  getvalue(value3);

  // Call the function that calculates the average
  // and then print it
  mean = find_average(value1, value2, value3);
  cout << "The average is "  << mean << endl;
}
```

```
// getvalue() - Input an integer value
void getvalue(int &x) {
  cout << "Enter a value ?";
  cin >> x;
}

// find_average() -  Find the average of three
// numbers
float find_average(int x, int y, int z)  {
      float sum, average;

      sum = (float) (x + y + z);
      average = sum / 3;
      return average;
}
```

Enumeration Constants in C

- Instead of writing

```
#define  NO          0
#define  YES         1
```

  we can write

```
enum          boolean {NO, YES};
```

- The first value is defined as 0, and each subsequent value is one greater, unless we explicitly state a value.

```
enum escapes {BELL = '\a', BACKSPACE = '\b',
    TAB = '\t', NEWLINE = '\n', VTAB = '\v'};
enum months {JAN = 1, FEB, MAR, APR, MAY, JUN,
          JUL,AUG, SEP, OCT, NOV, DEC }
          /* FEB is 2, MAR is 3, etc. */
```

enum in C++

- In C, the keyword **enum** must appear before the type when declaring variables:

```
enum days {sun, mon, … , fri,
   sat};
enum   days today;
```

- This is NOT necessary in C++:

```
days today;
```

struct in C++

- Unlike C, the keyword struct is not required when declaring variables of a struct type:

```
struct myDataType    {
};
myDataType myData;
```

#define

- In, C we have used **#define** to define constants. The preprocessor replaces each occurrence of the name with its value.
- We can also use it to define simple functions
- #define sqr(x) ((x)*(x))
- We include parentheses to ensure its correct translation by the preprocessor.

`const`

- The compiler sees the program after the preprocessor is finished, so the error messages reflect the preprocessed code, not the original source code.
- The const statement ensures that the compiler produces error messages that reflect what was originally written:
- const float pi = 3.14159;

`inline` functions

- Functions call can take a large amount of time to execute.
- Inline functions avoid this by inserting the code for the function in the object code.

```
inline float abs(x)
   { return (x>=0)? x: -x;}
```

- Because an inline function's code is physically inserted in the program each time its called, we limit its use to small functions.