Comp151

Definitions & Declarations

Example: Definition

```
/* program1.cpp */

#include <iostream.h>
#include <string.h>

int global_var = 23;                    // global variable definition

void reverse_print(const char* s)    // function definition
{
   for (int j = strlen(s) - 1; j >= 0; --j)
   cout << s[j];
   cout << endl;
}
```

Example: Declaration

```
/* program2.cpp */

#include <iostream.h>

extern int global_var;                                    // external variable declaration
extern void reverse_print(const char* s); // external function declaration

void main(int argc, const char* argv[])
{
   float local_var;                                       // local variable definition
   local_var = 987.654;

   cout << "global var = " << global_var << endl;
   cout << "local var = " << local_var << endl;
   cout << "input string backwards = ";
   reverse_print(argv[1]);
}
```

Definition

- A **definition** introduces a variable's or a function's name and type.
- A variable definition reserves a number of bytes of memory for the variable.
- A function definition generates code for the function.
- In both cases, definitions cause memory to be allocated to store the variable or function.
- An object must be defined exactly once in a program.*

*Except inline function definitions (which we'll discuss in a moment).

Declaration

- The **declaration** of a variable announces that the variable exists and is defined somewhere else (in the same file, or in a different file). The connection is made when the object files are linked.
- A declaration consists of the variable's name and its type preceded by the keyword `extern`.
- A declaration does not generate code, and does not reserve memory.
- There can be any number of declarations for the same object name in a program.
- If a declaration is used in a file different from that with the definition of the object, the linker will insert the real memory address of the object instead of the symbolic name.
- In C++, a variable must be defined or declared to the program before it is used.

Advantages of Header Files

- In general, a header file provides a centralized location for:
  - external object declarations
  - function declarations
  - class definitions (but <u>not</u> non-inline member function definitions)
  - inline function & member function definitions

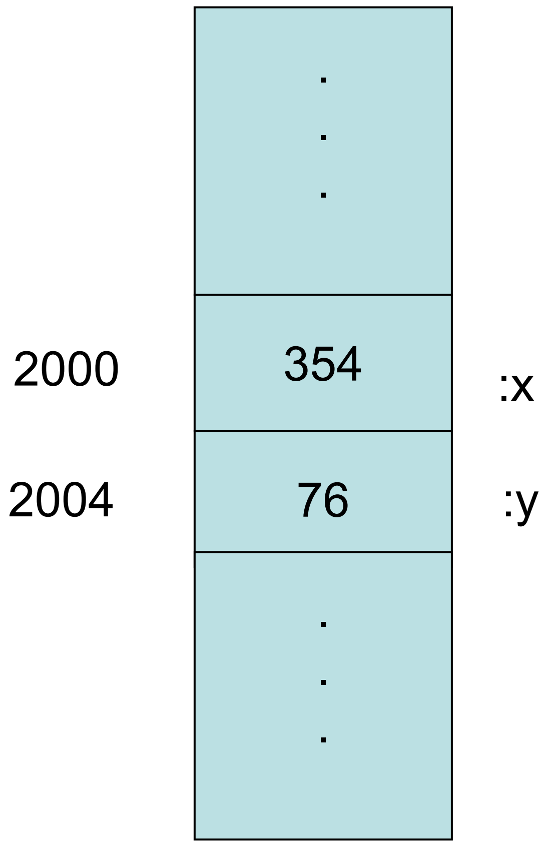
- The advantages are:
  - 1. By including the header files, all files of the same piece of software are guaranteed to contain the same declaration for a global object or function.
  - 2. Should a declaration require updating, only one change to the header file will need to be made.

Variables

- A **variable** is a symbolic name assigned to some memory storage.

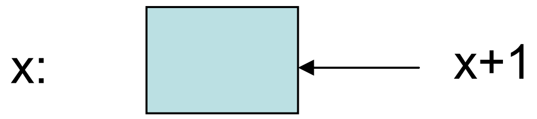
- The size of this storage depends on the type of the variable, compiler, and platform.
  - e.g., on x86 under Windows, `char` is 1 byte long and `int` is 4 byte long.

- The difference between a <u>variable</u> and a <u>literal constant</u> is that a variable is addressable.



Key distinction: lvalue vs. rvalue

[interpretation of " x = x + 1 "]



- A variable has dual roles, depending on where it appears in the program, it can represent
  - **lvalue**: the location of the memory storage
  - **rvalue**: the value in the storage

- They are so called because a variable represents an lvalue (or rvalue) if it is written to the left (or right) of an assignment statement. Thus, the following are invalid statements in C++:

```
4 = 1;
grade + 10 = new - grade;
```