CSC 211: Computer Programming
Header Files and Constructors

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THINK BIG WE DO℠

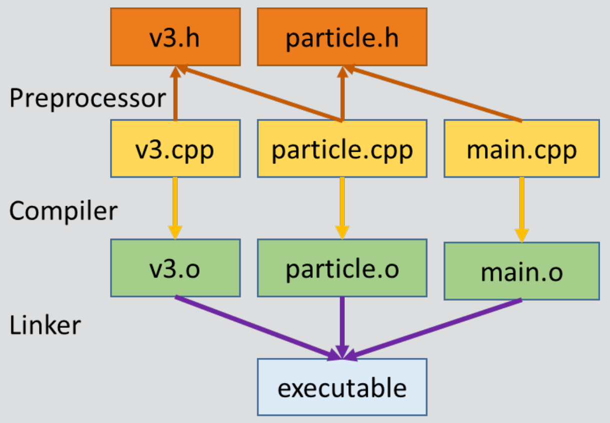
Original design and development by Dr. Marco Alvarez

Header Files

Separate compilation

- Source code can be divided into multiple files
  - source files can be compiled separately
  - enterprise code files can take hours to compile
    - Source code separation eliminates the need to compile everything, all the time
- Classes can be implemented in their own files
  - allows reusing codes in multiple programs
  - source files including class methods and function definitions
  - header files including declarations and global constants

Compiling multiple files



```
g++ v3.cpp particle.cpp main.cpp -o executable
```

https://devblogs.nvidia.com/separate-compilation-linking-cuda-device-code/

#include

- Used for including header files
  - usually contains class declarations, function prototypes, or global constants
- When used with < >
  - The preprocessor searches in an implementation dependent manner, normally in search directories pre-designated by the compiler/IDE. This method is normally used to include standard library header files
- When used with " "
  - The preprocessor searches first in the same directory as the file containing the directive, and then follows the search path used for the #include <filename> form. This method is normally used to include programmer-defined header files.
- Cannot compile header files directly!

Multiple declarations of classes

- With large projects, multiple declaration of classes must be prevented
- Use `#ifndef`

```
#ifndef DATE_H
#define DATE_H

class Date {
    // ...
};

#endif
```

Multiple declarations of classes

- Do header guards need to be capital or use an underscore instead of a dot?
- Preprocessor definitions have to use valid identifiers.
- Dots are not valid in identifiers. There is also a convention that preprocessor definitions (especially preprocessor macros) use all-uppercase names, to distinguish them from non-preprocessor identifiers.
- Not a hard and fast rule, just convention

Constructors

Constructors

- Special `methods` used to initialize data members when objects are created
- A constructor …
  - … is a member function (usually `public`)
  - … must have the same name as its class
  - … is automatically called when an object is created
  - … does not have a return type (not even `void`)

`constructors cannot be called as other methods`

Example

```
class Date {
    private:
        int month;
        int year;
        int day;

    public:
        Date();   No return
                  value

        // ...
};
```

Example: `Date`

```
#ifndef DATE_H
#def DATE_H
class Date {
    private:
        int month;
        int year;
        int day;

    public:
        Date();
        void print();
};

endif
```

```
#include "date.h"
#include <iostream>

Date::Date() {
    month = 1;
    day = 1;
    year = 1970;
}

void Date::print() {
  std::cout << month << '-' <<
day << '-' << year << '\n';
}
```

```
#include "date.h"

int main() {
    Date mydate;

    mydate.print();
}
```

```
g++ date.cpp main.cpp -o exec
```

Overloading constructors

- A constructor with no parameters is also known as the **default constructor**
- Classes may have multiple constructors
  - constructors are **overloaded** by defining constructors with different parameter lists

```
Date();
Date(int m, int d, int y);
```

Synthesized default constructor

- If you don't define any constructor, C++ will define one default constructor for you
- If you define at least one constructor, C++ will not add any other (not even the default constructor)

Initialization lists

- C++ allows for optional initialization lists as part of the constructor definition

```
Date::Date(int _d, int _m, int _y) {
    day = _d;
    month = _m;
    year = _y;
    // more statements
}
```

Same as…

```
Date::Date(int _d, int _m, int _y) : day(_d), month(_m), year(_y) {
    // more statements
}
```

Lets Try it

- Modify Point2D.cpp (on GitHub at ~/code) so it includes the following:
  - Default Constructor
  - Parameterized Constructor
- Once working, break it up into:
  - Class file (Point2D.cpp)
  - Header/Interface file (Point2D.h)
  - Driver (main.cpp)