CSCI 262

2 – Libraries and Interfaces

Functions

Function:
• A block of code separated out, given a name
• Typically has a single purpose
  — E.g., calculate the square root of a number
• In C++:

```cpp
int myfunc(string p1, double p2) {
    // code goes here
    return answer;
}
```

Return type
Parameters
Returns a value (optional-ish)

Libraries

Well written, general purpose functions can be reused.
• Implementing fast/provably correct algorithms
• Perhaps written by most knowledgable programmers (e.g., Microsoft)
• Well tested over time

The preferred mechanism for reuse is the library.

Example: cmath

`<cmath>` library

Implements many useful math functions:
- `abs(x)` – absolute value
- `sqrt(x)` – square root
- `floor(x), ceil(x)` – floor and ceiling
- `exp(x)` – e^x
- `log(x), log10(x)` – natural and base 10 log
- `pow(x, y)` – x^y
- Trig functions, etc.

Interfaces

Interface:
• The user-facing part of the library
• The set of functions available

The interface hides the complexity of the underlying implementations (how does sqrt work?)

Interface Illustrated

Consider a generic car:
• Steering wheel
• Accelerator
• Brake pedal
• Gear shift (and maybe clutch)
• Mirrors

These form the car’s interface.

Implementation: varies by make, model, year

If you know how to drive, you can probably drive any car (ignoring automatic vs. manual) because you know how to use the standard interface.
Example: Vector

The StanfordCPPLib (more in a bit) defines a class template (more later in the semester) for Vectors:

For a Vector<T>, the interface includes:

- void add(T value); // add to the end
- T get(int idx); // get value at idx
- void remove(int idx); // erase value at idx
- void clear(); // erase all values
- bool isEmpty(); // are there any values?
- int size(); // how many values are there?
- T& operator[int idx] // access element at idx

Interfaces and Header Files

- Recall:
  - Before we use a function, it must be declared
  - Function prototypes declare functions but do not define them
    - E.g.,
      ```
      int my_function(double, string);
      ```
- Header files (.h files)
  - Provide function prototypes only for “exported” functions – the ones meant for your use
  - Defines the interface for a library or subset

Standard Libraries

C++ defines many standard libraries:

- cmath
- string
- iostream
- Many others, including implementations of important data structures

We’ll learn more about these as the semester progresses.

Stanford CPP Lib

- Written for teaching purposes
- Goes with your textbook
- Implements various convenience functions
  - Input/output (simpio.h)
  - File handling (filelib.h)
  - String functions (strlib.h)
- For our purposes, the most important thing:
  - Provides basic data structures with simple interfaces
  - Can focus early on using data structures, not implementing them

Using the Stanford CPP Lib (Demo)