Object-Oriented Programming

Using C++

Course Contents

- Introduction to object-oriented programming
  - with a strong software engineering foundation
  - aimed at producing and maintaining large, high-quality software systems.

Buzzwords

- encapsulation 封装
- inheritance 继承
- polymorphism 多态
- overriding 覆盖
- interface 接口
- cohesion 内聚
- coupling 耦合
- collection classes 容器
- template 模板
- responsibility-driven design 责任驱动设计

Textbooks

- C++ Prime
- Thinking In C++,Ver. 2,Vol. 1 & 2
- References:
  - The C++ Programming Language
  - C++: The Core Language
  - Essential C++
  - Effective C++
  - Inside the C++ Object Model
  - C++ Templates

Assessment

1. In-class performance: 5%, on 学在浙大
2. Assignments: 16%, one problem set for each week, on PTA, due next lecture
3. 8 Lab/Project: 24%
4. Mid-Term Exam: 5% on PTA, 90-min at lab period, week 9/10
5. Final Exam: 50%

Tools for C++

- for Windows
  - gcc on WSL 2.0 & Ubuntu (Windows) or
  - MinGW-W64 aka gcc on MSY32 (https://code.visualstudio.com/docs/cpp/config-mingw)
- for MacOS
  - clang+llvm (XCode cmd-line tools)
- Visual Studio Code
- https://lightly.teamcode.com

Introduction to C++

The trip begins...

The C Language

- Strengths
  - Efficient programs
  - Direct access to machine, suitable for OS and ES
  - Flexible
- Weakness
  - Insufficient type checking
  - Poor support for programming-in-the-large
  - Procedure-oriented programming

Bjarne Stroustrup

- http://www.research.att.com/~bs/homepage.html
- C++ was first designed and implemented by Bjarne Stroustrup, AT&T, early 1980's
- Oct. 2002, Stroustrup visited Zhejiang Univ.
- The Design and Evolution of C++, Bjarne Stroustrup, Addison-Wesley, ISBN 0-201-54330-3

Brief history of C++ (1)

- 1978: BS at Cambridge, UK.
  - Simulation program in Simula
  - Supports classes, inheritance, and type check Poor performance

- 1979: BS at AT&T Labs, Cpre, C w/ classes
- 1980: most C++ features but virtual functions
- 1983: C++ w/ virtual functions, named C++ by Rick Mascitti 1985: Cfront
- 1985:“The C++ Programming Language”
- 1990:ANSI C++ Committee ISO/ANSI Standard C++ in 1998: ISO/IEC 14882 (http://www.open-std.org/jtc1/sc22/ wg21/)

Goal for C++

- Support for object oriented programming (from SmallTalk) to combine flexibility and efficiency of C

C and C++

- C++ builds on C
  - Knowledge of C helps you in C++
  - C++ support more styles of programming
  - C++ provides more features 26

C++ improvements

- Data abstraction
- Access control
- Initialization & cleanup
- References
- Function overloading
- Streams for I/O
- Name control
- Operator overloading
- More safe and powerful memory management
- Templates
- Exception handling

C++ can be viewed as a “better” C

- `C++` => `C=C+1`
  but...
- C++ is not C
  - Focus on C++ as a language in its own right
- C++ is a hybrid language, supports
  - Procedure-oriented programming
  - Object-oriented programming
  - Generic programming

The First C++ Program

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

int main()
{
  cout << "Hello, World! I am " << 18 < Today!" << endl;
  return 0;
}
```

Read input

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

int main()
{
  int number;
  cout << "Enter a decimal number: ";
  cin >> number;
  cout << "The number you entered is " << number <<" endl;
  return 0;
}
```