

C++ Workshop

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Classifying C++

Formally

- Compiled
- Statically (not strictly) Typed
- Object Oriented
- Systems Language

Informally

- Large, fast moving standard
- Often a strict subset is used
- 'Idiomatic' C++, tutorials fall out of date

C++ versus C

C	C++
...well, C	old: "C with classes"
portable standard library (*libc)	new: distinct language, roots in C
control, specificity	comprehensive standard library
	faster development

"There are only two kinds of languages: those that people [complain] about and those that nobody uses." – Bjarne Stroustrup, `comp.lang.c++.releases.4.1.messages.1994.07.14.01`

"Within C++, there is a much smaller and cleaner language struggling to get out" – Bjarne Stroustrup, The Design and Evolutions of C++ [1994]

Modern Macros: `const` and `constexpr`

- pitfalls of macros, use of algorithm (example: `max.cc`)
- `const`, `constexpr` (example: `fib.cc`)

What if types were... parameters? (example: `maxt.cc`)

STL Containers

collection of data, with template type T :

- `std::pair<T>`: a... pair!
- `std::vector<T>`: lookup $O(1)$, change $O(n)$
- `std::array<T>`: lookup $O(1)$, change $O(n)$ (size immutable)
- `std::list<T>`: lookup $O(n)$, change $O(1)$
- `std::set<T>`: general collection; with union, intersection, ...

Fun with vectors

- Task 1: printing a list with `auto` and `for-range`
- Task 2: sorting a list (Algo professors beware!)
- Task 3: sorting a list with lambdas
- Task 4: `any_of`, `find_if`, predicates with lambdas
- Task 5: emulating folds

Linting: `cpplint`

- What is a linter?
- 1978 — `lint`, C programs
- 2011 — `cpplint`, C++ programs, Google's style guide

Building and Build Systems: CMake

- Build systems and their use cases
- Structure of a CMakeLists.txt

Compiler choices:

- Which compiler, g++, clang++, etc.
- Warnings: -Wall, -Wextra, -Werror, -pedantic, -Wno-*, etc.
- Optimization: -pipe, -DNDEBUG, -O2, -Os, etc.
- Standards: -std=c++20
- Debugging: -ggdb
- strip for size constraints
- See `man g++` or other compiler documentation