Wrapping Up The STL

Bad Dad Joke of the Day:
- A limbo competitor walks into a bar. He loses.

Creds: CZ
Game Plan

- STL Conclusion
- Announcements
- Let’s Put It All Together...!
You’ve now seen it all!

- Algorithms
- Iterators
- Containers
- Functors/Lambdas
- Adaptors

And more!
You’ve now seen it all!

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And more!

- Algorithms
- Iterators
- Containers
- Functors/Lambdas
- Adaptors

And more!
Abstractions allow us to express the general structure of a problem instead of the particulars of its implementation.

Rather than solve specific instances, solve the problem in a general setting!
We started off with basic types:

- char
- int
- double
- ...

Each type was conceptually a “single value”..
Abstraction in the STL

Basic Types
Abstraction in the STL

Can we keep track of a collection of basic types, regardless of what the type is?
Abstraction in the STL

Many programs require a collection of basic types:

A `std::vector<int>` representing student ages

A `std::map<std::string, int>` of names to phone numbers

Containers let us perform operations on basic types, regardless of what the basic type is.
Abstraction in the STL

Containers

Basic Types
Abstraction in the STL

Can we perform operations on containers regardless of what the container is?
Iterators allow us to abstract away from the container being used.

Similar to how containers allow us to abstract away from the basic type being used.

Operations like sorting, searching, filtering, partitioning, and more can be written to work with almost any container.
Abstraction in the STL

Can we operate on *iterators* regardless of what type of container the iterator is for?
Abstraction in the STL

The STL contains pre-written algorithms that:

- operate on iterators, which lets them work on many types of containers, and
- often apply functors, which allows generalization of the algorithm’s applications
Abstraction in the STL

- Algorithms
- Iterators
- Containers
- Basic Types
Congratulations!

“As mathematicians learned to lift theorems into their most general setting, so I wanted to lift algorithms and data structures.”

— Alex Stepanov, inventor of the STL
Announcements
Announcements

- Office hours:
  - See updated Piazza post!
  - **Anna**:
    - Wed, 10 am - 11:30 am
    - Thurs, 10 am - 12 pm
    - Tues and Thurs, 3 - 3:30 pm before class (by request)
    - Thurs, 4:30 - 5 pm after class
  - **Avery**:
    - Tues, 4:30 - 5 pm after class
    - Tues, 7 - 9 pm
    - Thurs, 3 - 3:30 pm before class (by request)
    - And more as assignment deadline approaches
Preview of Assignment 2

Part A: due Friday, November 1 (no more than 2 hours)
Part B: due TBA

Assignment 2 Preview

- `set` vs. `unordered_set`
Assignment 2 Preview

● set vs. unordered_set

● Set: keys in sorted order, faster to iterate through a (sorted) range of elements

● Unordered set: faster to access individual elements by key
Today

Let’s put it all together!
THE FEDERALIST:
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AS AGREED UPON BY THE FEDERAL CONVENTION,
SEPTEMBER 17, 1787.

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The FEDERALIST, No. 10.

To the People of the State of New-York.

AMONG the numerous advantages promised by a well conducted Union, none deserves to be more accurately developed than its tendency to break and control the violence of faction. The friend of popular governments, never finds himself so much alarmed for their character and fate, as when he contemplates their propensity to this dangerous vice. He will not fail therefore to let a due value on any plan which, without violating the principles to which he is attached, provides a proper cure for it. The infidelity, injustice and confusion introduced into the public councils, have in truth been the mortal diseases under which popular governments have every where perished; as they continue to be the favorite and fruitful topics from which the adversaries to liberty derive their most specious declamations. The valuable improvements made by the American Constitutions on the popular models, both ancient and modern, contain

The influence of fagacious leaders may kindle a flame within their particular States, but will be unable to spread a general conflagration through the other States: A religious feit, may degenerate into a political faction in a part of the continent; but the variety of fields dispersed over the entire face of it, must secure the national Councils against any danger from that source: A rage for paper money, for an abolition of debts, for an equal division of property, or for any other improper or wicked projects, will be least apt to pervade the whole body of the Union, than a particular member of it; in the same proportion as such a malady is more likely to taint a particular county or district, than an entire State.

In the extent and proper structure of the Union, therefore, we behold a republican remedy for the diseases most incident to republican Government. And according to the degree of pleasure and pride we feel in being Republicans, ought to be our zeal in cherishing the spirit and supporting the character of Federalists.

PUBL I US.
Can we discover an author’s identity from their writing?
Can we discover an author’s identity from their writing?

**Stylometry**  
*noun*  
\(\text{sty} \cdot \text{lom} \cdot \text{e} \cdot \text{try}\)  
\(\text{st} \i \text{l\'æm\'æ\, trē, }\text{trē}\)  
*plural*  
-es  

**Definition of stylometry**  
: the study of the chronology and development of an author's work based especially on the recurrence of particular turns of expression or trends of thought
The Idea

Authors have an underlying writing style.

Subconsciously writers tend to write in a consistent manner.

...
The Idea

Authors have an underlying **writing style**.

Subconsciously writers tend to write in a **consistent** manner.

...  

**Could we use these tendencies as a literary fingerprint?**
The Idea

We need a writer invariant.
The Idea

We need a writer invariant.

Function words:

● Syntactic glue of a language
● E.g. the, I, he, she, do, from, because...
The Idea

Let’s imagine our language only has 3 function words:

[I, the, there]

Deep into that darkness peering, long I stood there, wondering, fearing, doubting, dreaming dreams no mortal ever dared to dream before.

- Edgar Allan Poe

I first met Dean not long after my wife and I split up. I had just gotten over a serious illness that I won’t bother to talk about, except that it had something to do with the miserably weary split-up and my feeling that everything there was dead.

- Jack Kerouac
The Idea

We can create a fingerprint vector for the two texts.

[I, the, there]

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The Idea

\[
\begin{bmatrix}
1 & 0 & 0
\end{bmatrix}
\]

\[
\begin{bmatrix}
4 & 1 & 1
\end{bmatrix}
\]
The Idea

\[[1, 0, 0] \quad [4, 1, 1]\]
The Idea

\[
\begin{bmatrix}
1 & 0 & 0 \\
\end{bmatrix}
\quad \quad
\begin{bmatrix}
4 & 1 & 1 \\
\end{bmatrix}
\]
The Idea

\[
\begin{bmatrix}
1 & 0 & 0
\end{bmatrix}
\quad \begin{bmatrix}
4 & 1 & 1
\end{bmatrix}
\]

The closer this angle, the more similar the texts.
The Idea

\[ \cos \theta = \frac{\vec{u} \cdot \vec{v}}{\|\vec{u}\| \|\vec{v}\|} \]
Let’s get coding!
The code for getting the word count (i.e. countOccurrences) will be really useful for the first part of assignment 2.
Next time

Class Design with Iterators

Starting a new unit: Object-Oriented Programming (in Modern C++)!