Useful trees implementations:  
<https://users.cs.fiu.edu/~weiss/dsaa_c++4/code/>

Topics:

1. chapter 1 (preliminary math stuff, preliminary c++ stuff)

2. Chapter 2 (complexity theory)

3. [Makefile](https://makefiletutorial.com/) and [g++](https://www3.ntu.edu.sg/home/ehchua/programming/cpp/gcc_make.html)

-I. look at current dir for header files.

And preprocessor does NOT produce assembly codes.

Preprocessor handles all the #include #define. And produces and intermediate version of source code.

Smart pointers: automatically delete the managed object and free up memory when the smart pointer goes out of scope or is no longer needed. This helps to prevent memory leaks and makes memory management safer and easier.  
Unique pointers: Only one std::unique\_ptr can manage a given object at any time. When the std::unique\_ptr goes out of scope, it deletes the managed object. std::unique\_ptr cannot be copied, but it can be moved.

Shared pointers: can be copied and moved.

A screenshot of a computer

Description automatically generated

4. Chapter 3 (iterators, standard template library(array, vector , list and

unordered\_maps), smart pointers), review code covered for these topics

Expect true/false, short answers, multiple choice(maybe),

1 coding question- give a problem and you must code up the solution,

1 question will have you analyze the compliexity of some code.

Proofs: identity a proof, and be familiar with the concept, no explicit Proofs

Skiped from chapter 1: Greatest common divisor algorithm

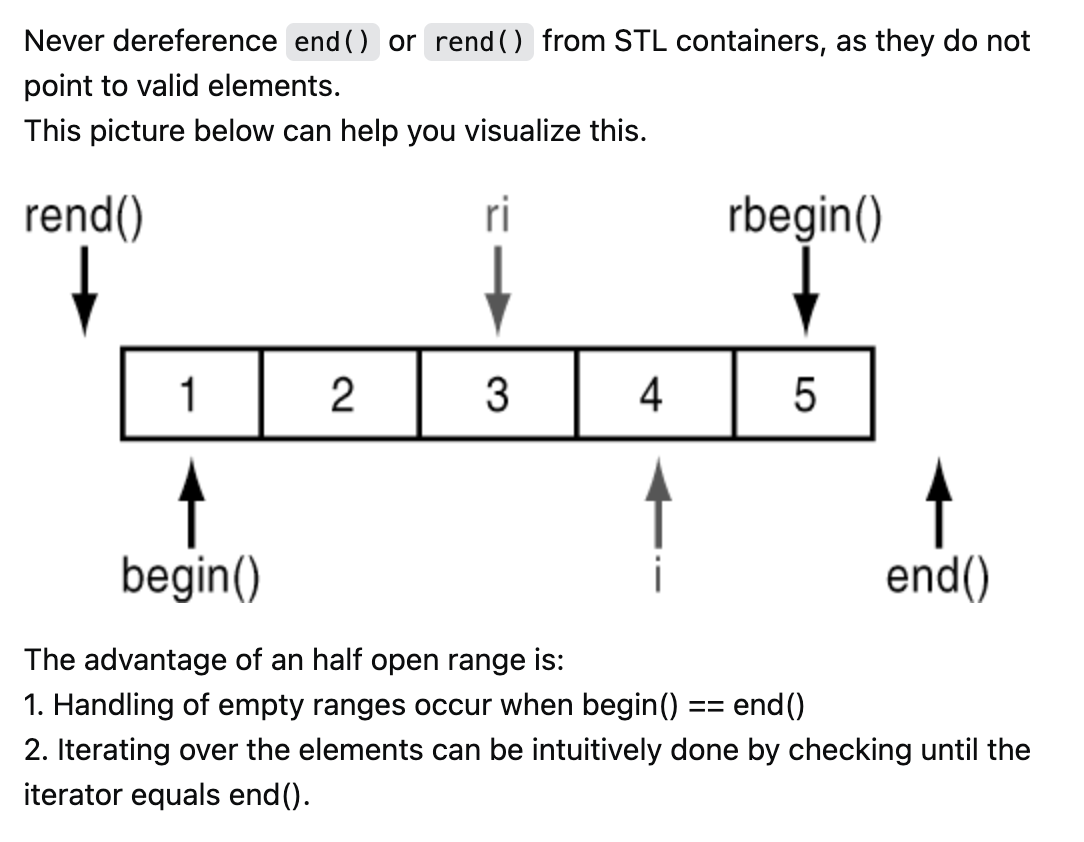
How the g++ compiler works and its architecture(preprocessor, compiler, linker),

and how to use make. In terms of questions I will only ask about things seen in

the Makefile for assignment 1.

makefile tutorials:  
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<https://stackoverflow.com/questions/34830192/what-doesone-past-the-last-element-mean-in-vectors>

Summary of C++ [vector](https://cplusplus.com/reference/vector/vector/at/) and C++ [List](https://cplusplus.com/reference/list/list/):

[iterator](https://cplusplus.com/reference/iterator/), assuming it’s a set, then Random\_Access is the entire set, and   
bidirectional is a subset  
A diagram of a flowchart

Description automatically generated

Vector and list both belong to containers of C++

|  |  |  |
| --- | --- | --- |
| Vector | List |  |
| Has its member functions:  e.g.: .at()  shrintk\_to\_fit()  erase() | Has its member functions  e.g. erase(), begin(), end(), but has less than vector |  |
| Has Random\_access\_iterators:  ++itr; 🡨pre-increment, preferred, return the incremented iterator  Itr++; 🡨 post-increment, less efficient, make a copy, increment the original, and retun the copy.  \*++itr; 🡨increment then dereference  \*it++; 🡨 dereference then increment  Itr == itr;  Itr != itr;  Swap(itr, itr2);  Can do arithmetic operations:  Itr – itr2;  Itr – 5;  Itr + 5;  5 + itr;  Itr[5]; 🡨 this does not move the itr, it only does the offset  Itr->display() | Has Bidirectional\_iterators:  Has mush less options than random\_access\_iterators |  |
| Has access to all member functions of iterator class | Has access to all member functions of iterator class |  |
| List.insert() | does not delete list2 |  |
| List.merge() | DELETES list2 |  |
| List.splice() | DELETES list2 |  |
|  |  |  |

You want to insert n random integers into an initially empty List or Vector, while keeping it sorted after each insertion.

Operations in Vector vs List:

|  |  |  |
| --- | --- | --- |
| Operation | Vector | List |
| Sort() – introSort worse and average | O(n\*logn) | O(n\*logn) |
| Search() on sorted | O(logn) on sorted vector using binary search | Doesn’t have this functionality |
| Search() on unsorted | O(n) have to iterate through | O(n) have to traverse |
| Insert() | O(n), have to move elements down after inserting new | O(1) doubly linked list |
| Overall for each element: | O(logn) + O(n) = O(n) | O(n) + O(1) = O(n) |
| Overall for n elements: | O(n^2) | O(n^2) |

Unordered\_map:

Uses forward iterators:

A diagram of a map

Description automatically generated  
[credit](https://www.alphacodingskills.com/cpp/notes/cpp-unordered-map-end.php)

|  |  |
| --- | --- |
| Operation: | Unorderdmap |
| Find() average | O(1) leverage hash table |
| my\_map1.find(1) | Returns iterator is found, else point to .end() |
| auto it = my\_map1.find(1); it->first; (\*it).first;  Same thing |  |
|  |  |
| auto it = map.find(1); it = map.erase(it); | Now it points to the next element, which is random |

Understanding mod notation, for example: is this true 9 = 7 mod 3 ? (false)

what is a template, how does it compile, explain why .h and .cpp is weird.

n + nlogn + 7= O(nlogn)

know important runtimes like selection sort = O(n^2)

make sure to know l and r values, references, pointers, big 5 constuctors

How to use arithmetic series, be able to explain what the other series are.

These are some examples but not all!