COMP6771
Advanced C++ Programming

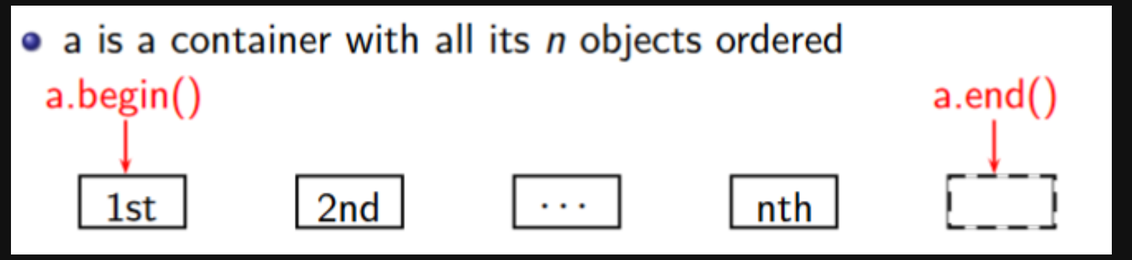
Week 2.2
STL Iterators

STL: Iterators

- Iterator is an abstract notion of a **pointer**
- Iterators are types that abstract container data as a **sequence** of objects (i.e. linear)
- Iterators will allow us to connect a wide range of containers with a wide range of algorithms via a common interface

STL: Iterators

- **a.begin()**: abstractly "points" to the first element
- **a.end()**: abstractly "points" to one past the last element
  - a.end() is not an invalid iterator value
- If iter abstractly points to the **k-th** element, then:
  - ***p** is the object it abstractly points to
  - **++p** abstractly points to the (k + 1)-st element



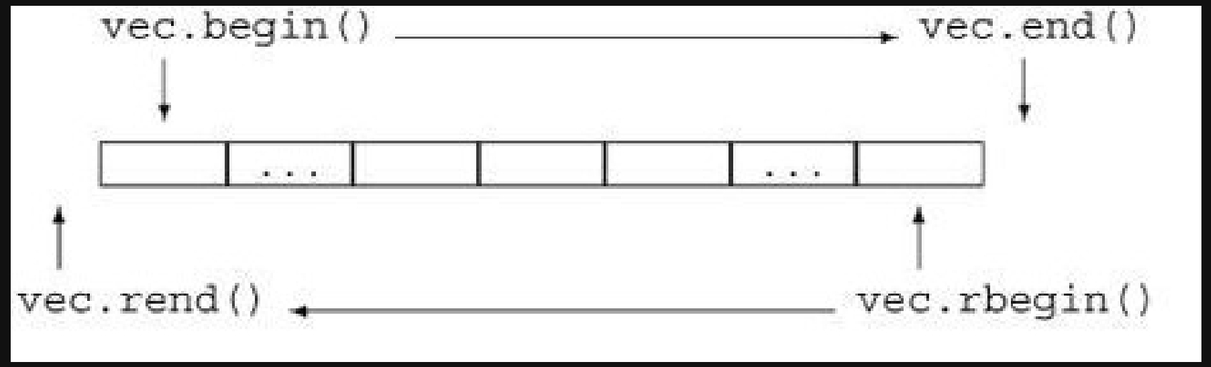

```cpp
#include <iostream>
#include <vector>
#include <string>

int main() {
  std::vector<std::string> names;
  for (auto iter = names.begin(); iter != names.end(); ++iter) {
    std::cout << *iter << "\n";
  }
  for (std::vector<std::string>::iterator iter = names.begin(); iter != names.end(); ++iter) {
    std::cout << *iter << "\n";
  }
}
```

demo204-iter1.cpp

Iterators, Constness, Reverse

```cpp
#include <iostream>
#include <vector>

int main() {
  std::vector<int> ages;
  ages.push_back(18);
  ages.push_back(19);
  ages.push_back(20);

  // type of iter would be std::vector<int>::iterator
  for (auto iter = ages.begin(); iter != ages.end(); ++iter) {
    (*iter)++; // OK
  }

  // type of iter would be std::vector<int>::const_iterator
  for (auto iter = ages.cbegin(); iter != ages.cend(); ++iter) {
    //(*iter)++; // NOT OK
  }

  // type of iter would be std::vector<int>::reverse_iterator
  for (auto iter = ages.rbegin(); iter != ages.rend(); ++iter) {
    std::cout << *iter << "\n"; // prints 20, 19, 18
  }

  // Can also use crbegin and crend
}
```

demo205-iter2.cpp



Stream Iterators

```cpp
#include <fstream>
#include <iostream>
#include <iterator>

int main() {
  std::ifstream in("data.in");

  std::istream_iterator<int>begin(in);
  std::istream_iterator<int> end;
  std::cout << *begin++ << "\n"; // read the first int

  ++begin; // skip the 2nd int
  std::cout << *begin++ << "\n"; // read the third int
  while (begin != end) {
    std::cout << *begin++ << "\n"; // read and print the rest
  }
}
```

demo206-iter3.cpp

Feedback