C++ STL Introduction

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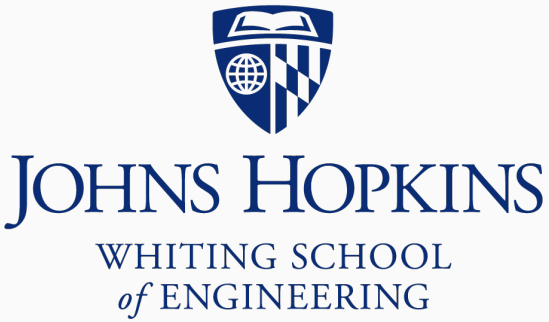

Source markdown available at github.com/BenLangmead/c-cpp-notes

C++ STL Introduction

Standard Template Library (STL) is C++'s library of useful data structures & algorithms

- Like `java.util`/`java.lang`
- Like Python sets, dictionaries, `collections`

Templates are covered in detail later in the course; we'll give them a quick look now

C++: Templates

Templates are a way of writing an object (`Node`) or function (`print_list`) to work with *any* type

You simultaneously define a *family* of related objects/functions

C++: Templates

```
struct Node {
    T payload;  // 'T' is placeholder for a type
    Node *next;
};

void print_list(Node *head) {
    Node *cur = head;
    while(cur != NULL) {
        cout << cur->payload << " ";
        cur = cur->next;
    }
    cout << endl;
}
```

We could replace `T` with `int`, `float`, `char`, or `std::string` and this would compile & work

C++: Templates

```
template<typename T>
struct Node {
    T payload;
    Node *next;
};

template<typename T>
void print_list(Node<T> *head) {
    Node<T> *cur = head;
    while(cur != NULL) {
        cout << cur->payload << " ";
        cur = cur->next;
    }
    cout << endl;
}
```

Same example, using templates

One `struct`/function, works for (almost) *any* type `T`

C++: Template primer

```
int main() {
    Node<float> f3 = {95.1f, NULL}; // float payload
    Node<float> f2 = {48.7f, &f3};  // float payload
    Node<float> f1 = {24.3f, &f2};  // float payload
    print_list(&f1);

    Node<int> i2 = {239, NULL};     // int payload
    Node<int> i1 = {114, &i2};      // int payload
    print_list(&i1);

    return 0;
}
```

```
$ g++ -c ll_template_cpp.cpp -std=c++11 -pedantic -Wall -Wextra
$ g++ -o ll_template_cpp ll_template_cpp.o
$ ./ll_template_cpp
24.3 48.7 95.1
114 239
```

C++: STL

With STL we use types like `vector<string>`

We read that type as "a vector *of* strings"

- `vector<string>` – a vector of `std::strings`
- `vector<float>` – a vector of `floats`
- `map<string, int>` – a structure that maps `std::strings` to `ints`

Similar to Java generics