

601.220 Intermediate Programming

C++ file I/O and stringstream

C++ I/O refresher

`iostream` is the main C++ library for input and output

```
#include <iostream>
```

```
using std::cin;    // default input stream  
using std::cout;  // default output stream  
using std::endl;  // end of line, flushes buffer
```

also

```
using std::cerr;  // default error output stream
```

`<<` is the stream insertion operator; used for output

`>>` is the stream extraction operator; used for input

C++ File I/O

- In C, `printf` wrote to `stdout` and `scanf` read from `stdin`
 - `fprintf` and `fscanf` were their counterparts for files
- In C++, we have `std::cout` and `std::cin`
 - `std::ofstream` and `std::ifstream` are their counterparts for files
- These are defined in the file-stream header
 - `#include <fstream>`
- `ofstream`: for writing to a file
- `ifstream`: for reading from a file
- `fstream`: for reading and writing to/from a file
- we use `<<` and `>>` operators for file I/O

C++ ofstream usage

```
// io1.cpp:
#include <iostream>
#include <fstream>
int main(){
    std::ofstream ofile( "hello.txt" );
    ofile << "Hello, World!" << std::endl;
    return 0;
}

$ g++ -c io1.cpp -std=c++11 -pedantic -Wall -Wextra
$ g++ -o io1 io1.o
$ ./io1
$ cat hello.txt
Hello, World!
```

C++ istream usage

```
// io2.cpp:
#include <iostream>
#include <fstream>
#include <string>
int main(){
    std::ifstream ifile( "hello.txt" );
    if (!ifile.is_open()) {
        std::cout << "failed to open hello.txt" << std::endl;
        return 1;
    }
    std::string word;
    while( ifile >> word )
        std::cout << word << std::endl;
    return 0;
}
```

```
$ g++ -c io2.cpp -std=c++11 -pedantic -Wall -Wextra
```

```
$ g++ -o io2 io2.o
```

```
$ ./io2
```

```
Hello,
```

```
World!
```

C++ I/O from/to strings

`std::stringstream`

Instead of reading or writing to console or file, it reads and writes to a temporary string ("buffer") stored inside

```
// io3.cpp:
#include <iostream>
#include <sstream>
int main(){
    std::stringstream ss;
    ss << "Hello, world!" << std::endl;
    std::cout << ss.str();
    return 0;
}

$ g++ -c io3.cpp -std=c++11 -pedantic -Wall -Wextra
$ g++ -o io3 io3.o
$ ./io3
Hello, world!
```

C++ stringstream details

- a string buffer that contains a sequence of characters
- `str()` function can be used to get the content of the buffer
- `str(string)` sets the content of the buffer to the string argument
- `<<` and `>>` operators can be used with `stringstream` to insert/extract content

C++ another stringstream example

```
// io4.cpp:
#include <string>
#include <iostream>
#include <sstream>
int main(){
    std::stringstream ss;
    ss << "Hello" << ' ' << 2019 << " world";
    std::cout << ss.str() << std::endl;
    std::string word1, word2;
    int num;
    ss >> word1 >> num >> word2;
    std::cout << word1 << ", " << word2 << " " << num << "!" << std::endl;
    return 0;
}
```

```
$ g++ -c io4.cpp -std=c++11 -pedantic -Wall -Wextra
```

```
$ g++ -o io4 io4.o
```

```
$ ./io4
```

```
Hello 2019 world
```

```
Hello, world 2019!
```


C++ stringstream differentiation

- Like the filestream, the stringstream also comes in flavors that only do reading or writing:
 - `istringstream` \leftrightarrow `ifstream`
 - `ostringstream` \leftrightarrow `ostream`