261102
Computer Programming

Lecture 5: File I/O

File Stream

- `#include <fstream>`

- **ofstream**:
  Stream class to write on files
- **ifstream**:
  Stream class to read from files
- **fstream**:
  Stream class to both read and write from/to files.

ofstream (Output File Stream)

```
1  #include <fstream>
2  using namespace std;
3
4  int main () {
5      ofstream dest;
6      dest.open ("C:\\Karn\\Secrets\\Temp\\Temp\\AV\\dest.txt");
7      dest << "Hello CPE#24 to a file.";
8      dest.close();
9      return 0;
10 }
```

dest.txt

Hello CPE#24 to a file.

ofstream (Output File Stream)

```
5      ofstream dest;
```

- Declare object name **dest** as output file stream class
- **dest** can now use similar to **cout**

```
6      dest.open ("C:\\Karn\\Secrets\\Temp\\Temp\\AV\\dest.txt");
```

- Associate output file stream to the destination file that we want to write into by using **dest.open()**
- Input of **dest.open()** is string of file location (file path and name)
- Use escape code '\\' for backslash

```
7      dest << "Hello CPE#24 to a file.";
```

- Use **<<** to write string into file (same as **cout**)

```
8      dest.close();
```

- After finishing, disassociate file to the stream by using **dest.close()**
- Any open file is automatically closed when the ofstream object is destroyed

ofstream (Output File Stream)

```
1  #include <fstream>
2  using namespace std;
3
4  int main () {
5      ofstream dest("C:\\Karn\\Temp\\Temp\\AV\\dest.txt");
6      dest << "Hello CPE#24 to a file.\n";
7      dest << "Yo!!!!.\n";
8      dest << "Yo!!!! Yo!!!!.\n";
9      dest.close();
10     return 0;
11 }
```

dest.txt

```
Hello CPE#24 to a file.
Yo!!!!.
Yo!!!! Yo!!!!.
```


ofstream (Output File Stream)

Appending Mode
All output operations are performed at the end of the file, appending the content to the current content of the file.

```
1  #include <fstream>
2  using namespace std;
3
4  int main () {
5      ofstream dest("C:\\Karn\\Temp\\Temp\\AV\\dest.txt",ios::app);
6      dest << "Yo!!!! Yo!!!! Yo!!!!.\n";
7      dest << "Yo!!!! Yo!!!! Yo!!!! Yo!!!!.\n";
8      dest.close();
9      return 0;
10 }
```

dest.txt

```
Hello CPE#24 to a file.
Yo!!!!.
Yo!!!! Yo!!!!.
Yo!!!! Yo!!!! Yo!!!!.
Yo!!!! Yo!!!! Yo!!!! Yo!!!!.
```

New contents added

ifstream (Input File Stream)

```
1  #include <iostream>
2  #include <fstream>
3  #include <string>
4  using namespace std;
5
6  int main () {
7      ifstream source;
8      source.open("C:\\Karn\\Temp\\Temp\\AV\\source.txt");
9      string textline;
10     getline(source,textline);
11     while ( textline != "\0"){
12       cout << textline << '\n';
13       getline(source,textline);
14     }
15     cout << "--------END---------" << '\n';
16     source.close();
17     return 0;
18 }
```

source.txt

```
1. Horizon: Zero Dawn
2. The Last Guardian
3. Doom
4. Deus Ex: Mankind Divided
5. Mass Effect: Andromeda
```

Console

```
1. Horizon: Zero Dawn
2. The Last Guardian
3. Doom
4. Deus Ex: Mankind Divided
5. Mass Effect: Andromeda
--------END---------
```


ifstream (Input File Stream)

```
7      ifstream source;
```

- Declare object name **`source`** as input file stream class
- **`source`** can now use similar to **`cin`**

```
8      source.open("C:\\Karn\\Temp\\Temp\\AV\\source.txt");
```

- Associate input file stream to the source file that we want to read by using **`source.open()`**
- Input of **`source.open()`** is string of file location

```
10     getline(source,textline);
```

- Use **`getline()`** to read string into variable **`textline`**

```
11     while ( textline != "\0")
```

- Read text line by line until program find line with no character **`"\0"`**

ifstream (Input File Stream)

```cpp
#include <iostream>
#include <fstream>
#include <string>
using namespace std;

int main () {
    ifstream source;
    source.open("C:\\Karn\\Temp\\Temp\\AV\\source.txt");
    string textline;
    getline(source,textline);
    while ( textline != "\0"){
      cout << textline << '\n';
      getline(source,textline);
    }
    cout << "--------END---------" << '\n';
    source.close();
    return 0;
}
```

1. Horizon: Zero Dawn
2. The Last Guardian
3. Doom

4. Deus Ex: Mankind Divided
5. Mass Effect: Andromeda

source.txt

1. Horizon: Zero Dawn
2. The Last Guardian
3. Doom
--------END---------

Console

ifstream (Input File Stream)

```cpp
int main () {
    ifstream source;
    source.open("C:\\Karn\\Temp\\Temp\\AV\\source.txt");
    string textline;
    bool havetext;
    havetext = getline(source,textline);
    while (havetext)
    {
      cout << textline << '\n';
      havetext = getline(source,textline);
    }
    cout << "--------END---------" << '\n';
    source.close();
    return 0;
}
```

- **`getline`** can return a reference to **`ifstream`**
- We convert **`ifstream`** into **`bool`**
  - Evaluated as **`true`** if the stream has no errors occurred
  - Evaluated as **`false`** if it failed to read

ifstream (Input File Stream)

```cpp
#include <iostream>
#include <fstream>
#include <string>
using namespace std;

int main () {
    ifstream source;
    source.open("source1.txt");
    string textline;
    while (getline(source,textline)){
      cout << textline << '\n';
    }
    cout << "--------END of 1st file-------" << '\n';
    source.close();
    source.open("source2.txt");
    while (getline(source,textline))    {
      cout << textline << '\n';
    }
    cout << "--------END of 2nd file-------" << '\n';
    return 0;
}
```

Hello!!! How are you?
My name is Fahsai.

source1.txt

I'm fine, thank you.
I'm your father.
May the force be with you.

source2.txt

Hello!!! How are you?
My name is Fahsai.
--------END of 1st file-------
I'm fine, thank you.
I'm your father.
May the force be with you
--------END of 2nd file-------

Console

Example 5-A: Find Average (from file)

```cpp
#include <iostream>
#include <fstream>
#include <string>
#include <cstdlib>
using namespace std;

int main () {
    int count;
    float sum = 0;
    string textline;
    ifstream source("mydata.txt");
    while (getline(source,textline))
    {
      cout << textline << '\n';
      sum += atof(textline.c_str());
      count++;
    }
    cout << "N = "<< count << '\n';
    cout << "Avg = "<< sum/count << '\n';
    source.close();
    return 0;
}
```

1.1
2.2
3.3
4.4
5.555
6.9

mydata.txt

1.1
2.2
3.3
4.4
5.555
6.9
N = 6
Avg = 3.90917

Console

Convert String to Number

- **#include <cstdlib>**
- atoi: Convert C-string to integer
- atol: Convert C-string to long integer
- atof: Convert C-string to double

  The function first discards as many whitespace characters as necessary until the first non-whitespace character is found. Then, starting from this character, takes as many characters as possible that are valid following a syntax resembling that of floating point literals (see below), and interprets them as a numerical value. The rest of the string after the last valid character is ignored and has no effect on the behavior of this function.
- strtod: Convert C-string to double

  Interpreting C-string as a floating point number and returns its value as a float. The function also sets the value of *pointer* to point to the first character after the number.
- strtof: Convert C-string to float (C++11 Standard)

Convert String to Number

- **#include <string>**
- **C++11 Standard**
- stoi: Convert string to integer
- stol: Convert string to long integer
- stoll: Convert string to long long integer
- stoul: Convert string to unsigned long integer
- stoull: Convert string to unsigned long long integer
- stof: Convert string to float
- stod: Convert string to double
- stold: Convert string to long double

Convert String to Number

- **atoi, atol, atof, strtod, strtof**
  - need C-string (C-style character array **char[]**) as input not C++ string object (**string**).
- **string_variable.c_str()** is used to convert C++ string object to C-string (as a pointer)

```
1  #include <iostream>
2  #include <string>
3  using namespace std;
4
5  int main()
6  {
7    char ctext[] = "12345";
8    string cpptext = "12345";
9    cout << atoi(ctext)*10 << '\n';
10   cout << atoi(cpptext.c_str())*10 << '\n';
11 }
```

```
123450
123450
```

C- string

C++ string object

Convert String to Number

```
1  #include <iostream>
2  #include <string>
3  #include <cstdlib>
4  using namespace std;
5
6  int main()
7  {
8      string text = "    1.2345   6789abcd";
9      cout << "atoi => " << atoi(text.c_str()) << endl;
10     cout << "atof => " << atof(text.c_str()) << endl;
11 }
```

```
atoi => 1
atof => 1.2345
```

```
string text = "ab123    1.23456789";
cout << "atoi => " << atoi(text.c_str()) << endl;
cout << "atof => " << atof(text.c_str()) << endl;
```

```
atoi => 0
atof => 0
```

```
string text = "-123.69e-5";
cout << "atoi => " << atoi(text.c_str()) << endl;
cout << "atof => " << atof(text.c_str()) << endl;
```

```
atoi => -123
atof => -0.0012369
```

Convert String to Number

```cpp
#include <iostream>
#include <string>
#include <cstdlib>
using namespace std;

int main () {
    string  text  = "    12.34e5";
    cout << "stoi => " << stoi(text) <<  endl;
    cout << "stod => " << stod(text) <<  endl;
    return 0;
}
```

```
stoi => 12
stod => 1.234e+06
```