File Streams

Due this week

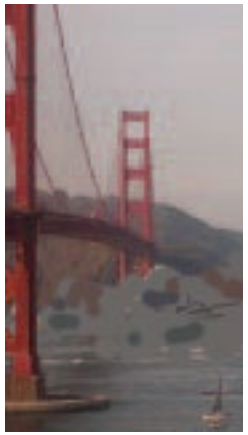
- **HW 5**
  - Write solutions in VSCode and paste in **CodeRunner**.
  - Extra-credit start early
  - Zip your .cpp files and submit on canvas. Check the due date! **No late submissions!!**
- **Mandatory Grading Interview -** Oct 3rd – 12th!
- **Quiz 5.** Check the due date! **No late submissions!**

Today

- Streams
  - Reading from files

Streams

Streams

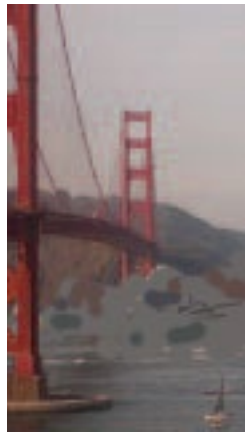


A very famous bridge

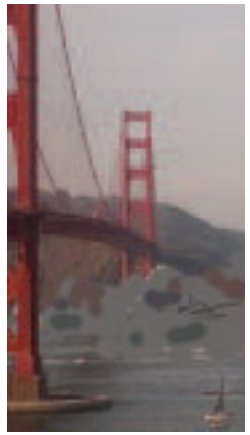
over a “*stream*”

Streams

A ship



Streams



in the stream

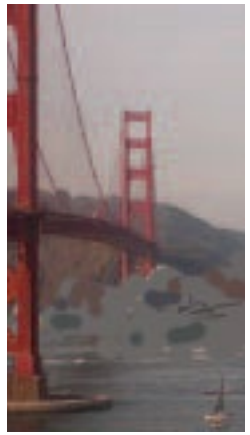
Streams

one at a time

Streams

A ***stream*** of ships

Streams



No more ships in the stream at this point

Let’s process the inputs we have so far

Streams

- Aaahhh… a delicious stream of sushi…

  (on conveyor belt)
- One at a time
- Input to your belly

Streams

- Aaahhh… a delicious stream of sushi…

  (on conveyor belt)
- One at a time
- Input to your belly
- Eventually, no more sushi

  (restaurant closes)

Reading and Writing Files

- The C++ input/output library is based on the concept of *streams*.
- An *input stream* is a source of data.
- An *output stream* is a destination for data.

- The most common sources and destinations for data are the files on your hard disk.
  - You need to know how to read/write disk files to work with large amounts of data that are common in business, administrative, graphics, audio, and science/math programs

Streams

```
This is a stream of characters. It could be from the
keyboard  or  from a file. Each of these is just a
character - even these:  3  -23.73 which, when input,
can be converted to: ints or doubles or whatever type
you like.
(that was a  '\n'  at the end  of the last line)
&*@&^#!%#$ (No, that was -not- a curse!!!!!!!!!!
¥1,0000,0000 (price of a cup of coffee in Tokyo)
Notice that all of this text is very plain -  No
bold or green of italics - just characters - and
whitespace (TABs, NEWLINES and, of course... the
other one you can't see: the space character:
(another '\n')
(&& another)
```

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other one you can't see: the space character:
(another '\n')
(&& another)

    Aren't you x-STREAM-ly glad this stream is over?
                    And there were no sound effects!!!
```

Reading and Writing Streams

- The stream you just saw is a plain text file.
- No formatting, no colors, no video or music (or sound effects).

- A program can read these sorts of plain text streams of characters from the keyboard, as has been done so far with `cin`.

Reading and Writing Disk Files

You can also read and write files stored on your hard disk:

- plain text files
- binary information (a binary file)
  - Such as images or audio recording

To read/write files, you use *variables* of the stream types:

`ifstream` for input from plain text files.
`ofstream` for output to plain text files.
`fstream` for input and output from binary files.

You must `#include <fstream>`

Opening a Stream

- To read anything from a file stream, you need to *open* the stream. (The same for writing.)
- *Opening a stream* means associating your stream variable with the disk file.
- The first step in opening a file is having the stream variable ready.

Opening a Stream

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- The first step in opening a file is having the stream variable ready.

Here's the definition of an input stream variable named **`in_file`**:

```
ifstream in_file;
```

Looks suspiciously like every other variable definition you've done – it is!
Only the type name is new to you.

Code for opening a stream

```
ifstream in_file;
in_file.open("input.txt"); //filename is input.txt
```

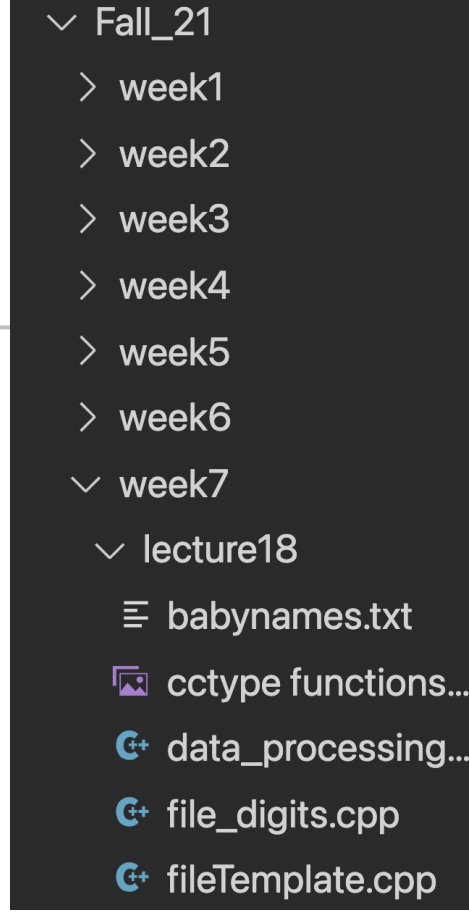
An alternative shorthand syntax combines the 2 statements:

```
ifstream in_file(“input.txt”);
```

- As your program runs and tries to find this file, it WILL ONLY LOOK IN THE DIRECTORY (FOLDER) IT IS LOCATED IN!

- This is a common source of errors. If the desired file is not in the executing program’s folder, the full file path must be specified.

File Path Names



File names can contain directory path information, such as:

UNIX
```
in_file.open("~/nicework/input.dat");
```

Windows
```
in_file.open("c:\\nicework\\input.dat");
```

When you specify the file name as a string literal, and the name contains backslash characters (as in Windows), you must **supply each backslash *twice*** to avoid having unintended *escape characters* in the string.

\\ becomes a single \ when processed by the compiler.

Failing to open

- The **`open`** method also sets a “not failed” condition
- It is a good idea to test for failure immediately:

```
in_file.open(filename);

// Check for failure after opening
if (in_file.fail())
{
     return 0;
}
```

or

```
if(!in_file.is_open())
{
     return 0;
}
```

Closing a Stream

- When the program ends, all streams that you have opened will be automatically closed.
- You *can* manually close a stream with the **close** member function:

```
in_file.close();
```

1. Create variable
2. Open file (provide filename)
3. Check if file opened successfully
4. Read from file
5. Close file

Reading from a stream

If you have the following stored in a file:

```
CSCI 1300
```

You already know how to read and write using files.

Yes you do:

```
string name;
int number;
```

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```

cin? **in_file**?

No difference when it comes to reading using **>>**.

Reading from a stream

- The **>>** operator returns a “not failed” condition, allowing you to combine an input statement and a test.
- A “failed” read yields a **`false`** and a “not failed” read yields a **`true`**.

```
if (in_file >> name >> number)
{
   // Process input
}
```

Reading from a stream

- You can even read ALL the data from a file because running out of things to read causes that same “failed state” test to be returned:

```
while (in_file >> name >> number)
{
   // Process input
}
```