

# CS 3005: Programming in C++

## WAV File Output

### Introduction

A WAV file is a file format that can be used to store sound data. It is actually a specific use of the RIFF file format. The WAV file consists of single RIFF chunk, that contains the “RIFF” header, a “fmt ” sub-chunk and a “data” sub-chunk. The “RIFF” header describes the file format, and the “fmt ” sub-chunk contains information about the audio format, such as the number of channels, and the “data” sub-chunk contains the actual audio data.

### RIFF Header

The “RIFF” header has three pieces of information.

- The ID, consisting of the 4 characters “RIFF”
- The Size, a 32-bit integer, which is the number of bytes in the file *after* the size. Or, in other words, the number of bytes in the file minus 8.
- The Format, consisting of the 4 characters “WAVE”.

### Assignment

In this assignment, you will start to create a class, `WAVFile` that supports the writing of WAV files.

### Programming Requirements

Depends on the `AudioTrack` class.

#### Create `library-audiofiles/endian_io.{h,cpp}`

Declare the following functions in the header file, and implement them in the cpp file. Some of the functions belong to the `little_endian_io` namespace, and others to the `big_endian_io` namespace. Be sure to declare them correctly.

#### `little_endian_io` Functions:

- `std::ostream& write_word(std::ostream& output_stream, int value, unsigned size);` Writes `size` bytes of `value` to `output_stream`. Starts with the least significant byte.
- `std::ostream& write_4_bytes(std::ostream& output_stream, int value);` Uses `write_word` to write 4 bytes.
- `std::ostream& write_2_bytes(std::ostream& output_stream, int value);` Uses `write_word` to write 2 bytes.
- `std::ostream& write_1_bytes(std::ostream& output_stream, int value);` Uses `write_word` to write 1 bytes.

#### `big_endian_io` Functions:

- `std::ostream& write_string(std::ostream& output_stream, const std::string& value);` Writes the string `value` to `output_stream` in order from first to last byte of the string.

#### Create `library-audiofiles/WAVFile.{h,cpp}`

#### `WAVFile` Class

#### Data Members:

The `WAVFile` class should contain data members to track the following information. These data members should be `protected` or `private`. They are not allowed to be `public`.

- `int` samples per second; The sampling rate of the data for the wave file.
- `int` bits per sample; The number of bits per sample in the wave file. Constrained to a multiple of 8 (specifically 8, 16, 24, or 32).

#### `public` Methods:

- `WAVFile(int samples_per_second, int bits_per_sample);` Initializes data members from the parameters to 0 in the initialization part of the constructor. Uses the setter methods to attempt to set the data members from parameters. Note, this means, if `samples_per_second` is less than 1 then the data member will still be set to 0, or if `bits_per_sample` is not a multiple of 8, then the data member will be set to 0.
- `int getSamplesPerSecond() const;` Returns the value of the data member.
- `int getBitsPerSample() const;` Returns the value of the data member.
- `void setSamplesPerSecond(const int samples_per_second);` Assigns the value of the data member. If the new value is less than 1, then the method should do nothing.
- `void setBitsPerSample(const int bits_per_sample);` Assigns the value of the data member. If the new value is not a multiple of 8 (8, 16, 24, or 32), then the method should do nothing.

## Update `library-audiofiles/Makefile`

- Add the `WAVFile` and `endian` files to the `Makefile` so the headers are installed and the `.o` file are added to the library.

## Additional Documentation

- [WAVE PCM soundfile format](#)
- [std::ostream](#)
- [std::ofstream](#)
- [namespace](#)
- [types](#)
- [Member initializer list](#)
- [if](#)
- [comparison operators](#)
- [logical operators](#)
- [std::stringstream](#)
- [arithmetic operators](#)
- [std::vector](#)
- [std::string](#)
- [#include](#)
- [const method](#)
- [references](#)
- [public/protected/private](#)
- [size\\_t](#)
- [classes](#)
- [class declaration](#)
- [class implementation file](#)
- [static\\_cast](#)
- [auto](#)
- [for \(counted\)](#)
- [for \(range\)](#)
- [address-of](#)

## Grading Instructions

To receive credit for this assignment:

- your code must be pushed to your repository for this class on GitHub
- all unit tests must pass
- all acceptance tests must pass
- all programs must build, run, and execute as described in the assignment descriptions.

## Extra Challenges (Not Required)

Describe possible additions and extensions that could be added without breaking the expected functionality. Careful not to give away too many possible exam tasks.