CAS 741: Problem Statement
A Fourier Series Library

Bo Cao, caob13@mcmaster.ca

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1 Goal

I intend to implement a library for Fourier series related computation. I will mainly implement the following functions.

- Compute the Fourier series of a given function.
- Compute the value of a function with given variable value and the Fourier series of this function.
- Implement the addition, subtraction, multiplication and division of Fourier series. That is, suppose that the functions $f(t)$ and function $g(t)$ have Fourier series F and G, respectively, this library computes the Fourier series of $f(t) + g(t)$, $f(t) - g(t)$, $f(t) * g(t)$, and $f(t)/g(t)$ from F and G.
- Implement some basic functions (sin, exp, etc.) of Fourier series. That is, suppose a function $f(t)$ with known Fourier series F, and a known basic function $g()$, we would like to compute the Fourier series of $g(f(t))$ from F.
- Formatted input and output of Fourier series.

The aforementioned function shall be a $\mathbb{R} \to \mathbb{R}$ function, whose Fourier series exists. Instead of verification by this library (due to foreseeable technical difficulties), this property shall be guaranteed by the users.

2 Motivation

An equation solver, whose development I currently participate in, utilizes Taylor series, and I intend to see if its Taylor series parts can be replaced by Fourier series ones. For this purpose, I need to implement a basic library for the Fourier series related computations, hence this library.

3 Environment

This library is developed and tested on the 64-bit Ubuntu 18.04, and might be tested on the macOS 10.14 and 10.15 (after its release).

This library's compatibility with other environments are not guaranteed nor tested, although I guess that it should be compatible with 64-bit Ubuntu 16.04.