Design Document - Numerical Integration

Lev Teytelman

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1 Program Description

This program calculates and prints integrals of functions over an interval using the Composite Simpson's 1/3 Rule. The functions themselves use various converging series to get an estimate of the outcomes.

2 Included Files

- functions.c - The source file providing functions corresponding to each input flag.

- functions.h - The header file providing the function declarations for use in other files.

- integrate.c - The file containing the `main()` function, argument processing, and usage help.

- mathlib.c - The source file with the implementations for various mathematical functions using converging series.

- mathlib.h - The header file with the declarations of the mathematical functions.

- test.c - Test cases for mathlib.c, testing function versatility.

- Makefile - The logic for compiling and linking files into one executable binary.

- README.md - A short explanation of the program and instructions for usage.

- DESIGN.pdf - This document, describes the program, included files, and how it works.

- WRITEUP.pdf - The document explaining the code in-depth and analyzing the results.

3   Structure

This assignment includes implementing converging series to calculate specific values such as square root, log, sin, cos, and others. The basic structure of these is presented in Python, and the goal is to turn it into a modular C function to calculate the expected outcome.

These functions are then passed into and used by an `integrate` function, which approximates the integral of a function over an interval by partitioning the area into small rectangles.

All this finally comes together in the user-facing program, where the user specifies command-line arguments to find the integral of a function, specifying the interval and optionally the number of partitions.