

Wenzhou-Kean University

Project

CPS2231: Computer Organization and Programming

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| Project Name: | LaTeX Calculator |
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# Introduction

## Data Structure

The tree data structure in this project is to parse LaTeX mathematical expressions, where the leaf nodes of the tree will store data, and the branch nodes of the tree will be used to store algorithms, or how to process the data.

## What is LaTeX

LaTeX is a document preparation system for TeX typesetting program. It offers programmable desktop publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing. With the typesetting power of LaTeX, it also provides an enormously powerful support for writing mathematical formulas, so that we can easily write mathematical expression on our computers without worrying about the layout ad format. For instance, the following mathematical expression,

could be transform from the LaTeX expression as below

E = \frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}

And for more complex mathematical expressions, LaTeX also provides excellent tools. For example, for the following mathematical expressions

its LaTeX expression is like:

\begin{aligned}

\nabla \cdot \nabla \psi &= \frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} +

\frac{\partial^2 \psi}{\partial z^2} \\

&= \frac{1}{r^2\sin\theta}\Big[\sin\theta \frac{\partial}{\partial r}(r^2\frac{\partial \psi}{\partial r}) +

\frac{\partial}{\partial \theta}(\sin\theta \frac{\partial \psi}{\partial \theta}) +

\frac{1}{\sin\theta}\frac{\partial^2\psi}{\partial \psi^2}\Big]

\end{aligned}

This is the power of LaTeX when dealing with mathematical formulas.

# Proposed Problem

With the power support of mathematical expression in LaTeX, we could easily write elegant and beautiful mathematical equation, however, this raises the problem that when writing mathematical expressions in LaTeX, that is we are not able to copy-and-paste them directly for calculations; we often need to remove the LaTeX identifier, such as \frac, from the expression such that we could calculate it with computer. For example, to calculate the result of which has the LaTeX expression like \frac{1}{2}, we need remove the whole \frac LaTeX identifier from the expression, and add a / sign between 1 and 2, so the LaTeX expression would become 1 / 2 which could easily calculate with computer, or just pasting it into Google, and it would give 0.5 as the result.

# Proposed Solution