Question 1: Series Sum Calculation - MIPS Assembly Code

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1 Introduction

This document describes the assembly code implementation in MIPS for calculating the sum of a series of the form $1^1 + 2^2 + 3^3 + \ldots + n^n$. The code showcases recursive function calls, user input and output, and basic arithmetic operations in MIPS assembly language.

2 Functionality

The program prompts the user to input an integer n. It checks if the input is a positive value and displays a warning message and exits if a non-positive value is entered. If the input is valid (positive), the program calculates and outputs the sum of the series up to n.

3 Recursive Approach

The calculation of the series sum involves a recursive function that computes the value of $1^1 + 2^2 + 3^3 + \ldots + x^x$ for a given positive integer x.

3.1 Base Case

The recursion has a base case where the function returns 1 when x is 1.

3.2 Recursive Calls

For values of x greater than 1, the function recursively calls itself with the argument $x - 1$. The base case and recursive step collectively contribute to calculating the sum of the series $1^1 + 2^2 + 3^3 + \ldots + n^n$. Formally we can write,

$$f(x) = \begin{cases} f(x-1) + x^x, & x > 1 \\ 1, & x = 1 \end{cases}$$