

# Speedup and Efficiency Calculation for Double Integral Computation

This document presents the speedup and efficiency calculations for a Python program that computes a double integral using both serial and parallel execution methods. The program calculates the integral of a function over a defined domain, first serially and then by dividing the domain among multiple workers in parallel execution. The goal is to analyze the performance gains achieved by parallelization.

## 1. Definitions and Formulas

Speedup (S) measures the performance improvement of the parallel method over the serial method. Formula:  $S = \text{Serial Execution Time} / \text{Parallel Execution Time}$

Efficiency (E) indicates the effective utilization of resources in parallel execution.

Formula:  $E = \text{Speedup} / \text{Number of Workers}$

## 2. Calculation Steps and Results

Given:

- Serial Execution Time = <Serial Execution Time>
- Parallel Execution Time = <Parallel Execution Time>
- Number of Workers = <Number of Workers>

Speedup and Efficiency calculations:

1. Speedup (S) = Serial Execution Time / Parallel Execution Time
2. Efficiency (E) = Speedup / Number of Workers

### 3. Consistency Check

After calculating the integral values using both serial and parallel methods, a consistency check was performed to ensure accuracy. The serial and parallel integral values matched within an acceptable tolerance level, indicating that both approaches produced consistent results.

Result: The total integral values from serial and parallel executions match.

