CS 301
High-Performance Computing

Lab 5: Problem C-1

Harsh Makwana (202001264)
Vivek Godhasara (202001451)

March 23, 2023

Contents

1 Introduction

1.1 Brief description of the problem.

Problem C-1 -> Block matrix multiplication.

In this problem, our task is to multiply two matrices of size N using the block matrix multiplication method. In the block matrix multiplication method, the matrix is divided into smaller square matrices and then multiplied. Additionally, here we will be writing the parallel code for the multiplication using pragma omp.

Now our goal is to write an optimal parallel algorithm for calculating the upper problem so that we can get optimal use of our processor. Here we describe the time differences with processor change using a graph.

1.2 The complexity of the algorithm (serial).

Here time complexity will be the same as conventional method and space complexity will also be the same.

So The time complexity of the algorithm is:

$$O(N^3)$$

For storing 3 matrices of NXN we will need

$$3XN^2$$

space. So The space complexity of the algorithm is:

$$O(N^2)$$

2 Hardware Details

2.1 Hardware Details of LAB207 Computer

- CPU - 4
- Socket - 1
- Cores per Socket - 4
- Size of L1 cache - 64KB
- Size of L2 cache - 256KB
- Size of L3 cache - 6MB

2.2 Hardware Details of Cluster

- CPU - 16
- Socket - 2
- Cores per Socket - 8
- Size of L1 cache - 64KB
- Size of L2 cache - 256KB
- Size of L3 cache - 20MB

3 PART 1: LAB207 Computer

3.1 Graph

Below we have depicted the Mean execution time vs problem size for Lab207 Computer.

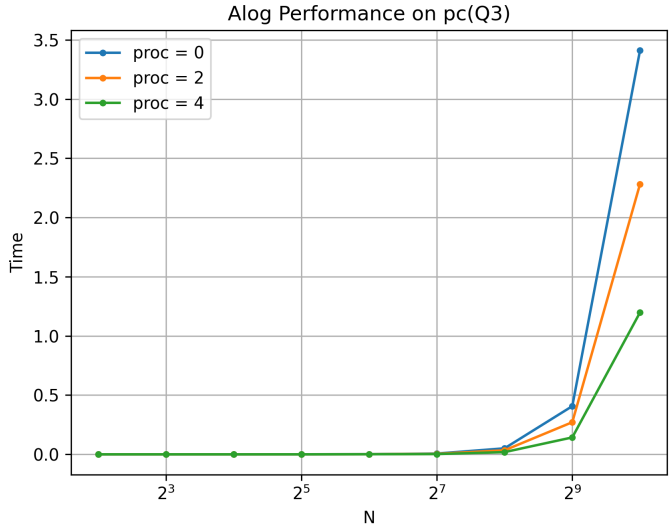

Figure 1: Algorithm time vs problem size - PC

4 PART 2: Cluster

4.1 Graph

Below we have depicted the Mean execution time vs problem size for Cluster.

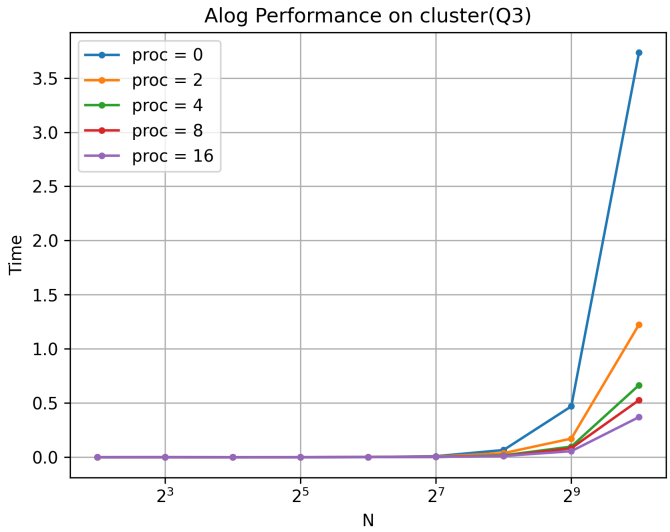

Figure 2: Algorithm time vs problem size - Cluster