CS 301
High-Performance Computing

Lab 3: Problem A-1

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Contents

1 Introduction

1.1 Brief description of the problem.

Problem A-1 -> Conventional matrix multiplication.

In this problem, our task is to multiply two matrices with size N using the conventional method of matrix multiplication. In the conventional method, we use three loops which are used to multiply the rows with the columns.

Now our goal is to write an optimal algorithm for calculating the upper problem so that we can get optimal use of our processor.

1.2 The complexity of the algorithm (serial).

As you can see in the uploaded code, We are doing matrix multiplication using the conventional method i.e. using three loops.

So The time complexity of the algorithm is:

$$O(N^3)$$

and 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 Profiling information

Here we have described the profiling information of the Lab207 Computer.

```
                     Call graph (explanation follows)


granularity: each sample hit covers 2 byte(s) for 0.07% of 13.79 seconds

index % time    self  children    called     name
                                             <spontaneous>
[1]    100.0   13.79    0.00                 main [1]
                0.00    0.00       2/2           diff [2]
-----------------------------------------------
                0.00    0.00       2/2           main [1]
[2]      0.0    0.00    0.00       2         diff [2]
-----------------------------------------------
```

Figure 1: Profiling information- PC

3.2 Graph

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

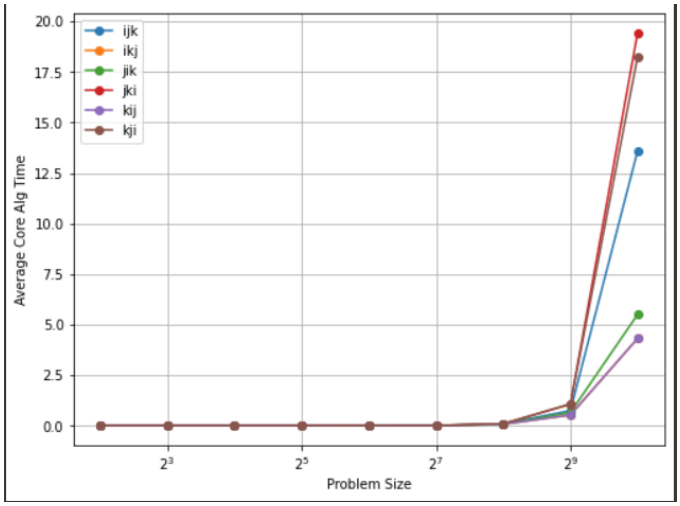

Figure 2: Algorithm time vs problem size - PC

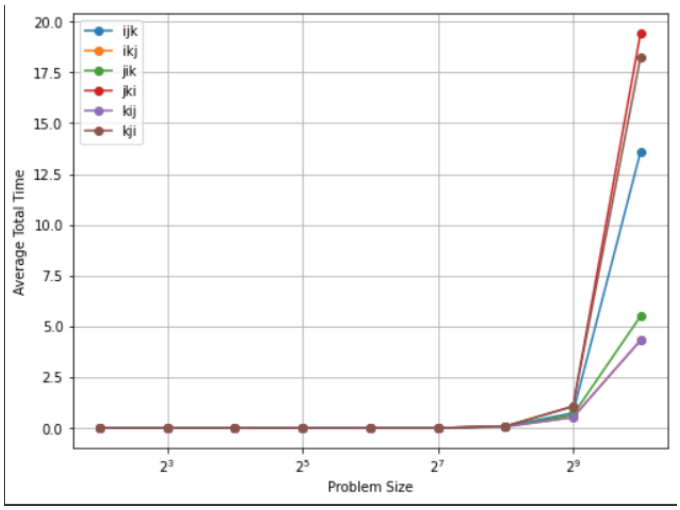

Figure 3: End-to-end execution time vs problem size - PC

4 PART 2: Cluster

4.1 Profiling information

Here we have described the profiling information of the Cluster.

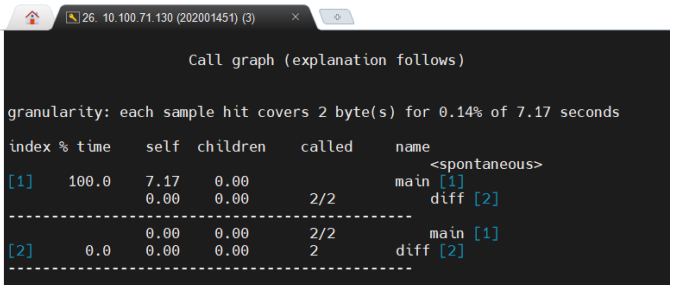

Figure 4: Profiling information - Cluster

4.2 Graph

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

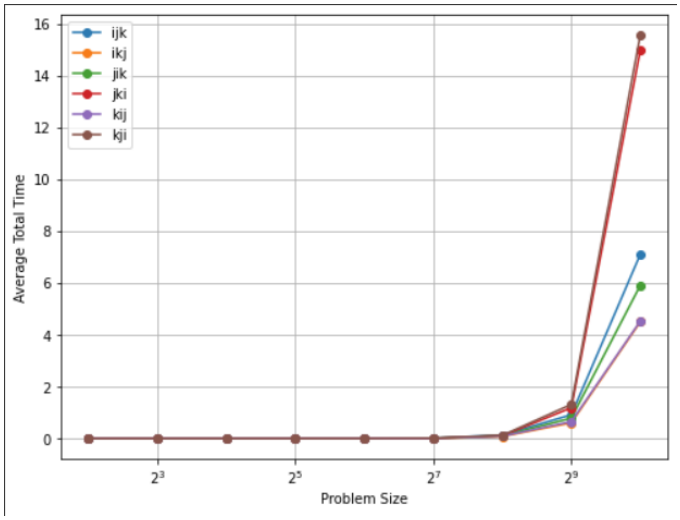

Figure 5: Algorithm time vs problem size - Cluster

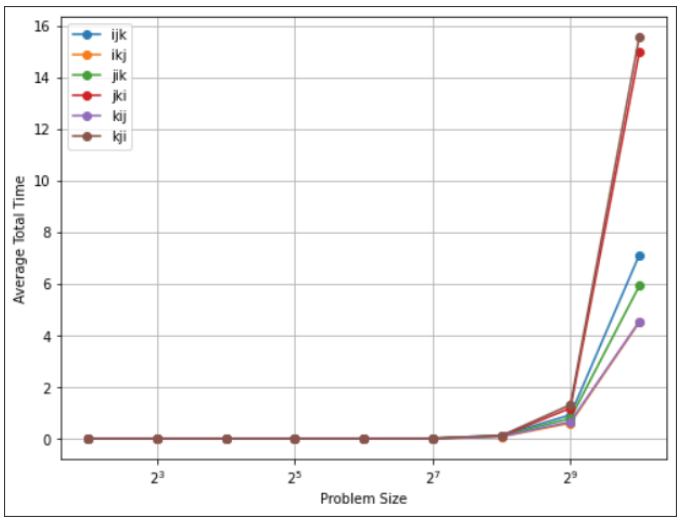

Figure 6: End-to-end execution time vs problem size - Cluster