**Part 1:**

The dominant computation time is matrix multiplication and data exchange between partitions. If the hardware communication latency is minimal for small portion size, the overall execution time can be roughly calculated by multiplying the calculation phase's duration by the number of iterations. Process generation and data distribution account for most of the overhead, with the maximum times for these two activities dictating the length of the first phase. Depending on the fundamental communication latency, a transition point is found when either process generation or data dissemination predominates. These findings are supported by performance graphs, which show that increasing the data size (k) reduces overhead effects and improves speed.

**Part 2:**

**A screenshot of a computer

Description automatically generated**

2.a: Best when = 5 and delay 20

A screen shot of a computer

Description automatically generated

2.b worse when p = 2 and delay 100

**Part 3:**

The following techniques can be used to analyze the performance of matrix multiplication.

1. Time Command – time command to use between breakpoints to understand the dominant phase of computation.
2. Variation Command – Ran the program multiple time with variation on to understand different processor scenarios. It remains same
3. Utilization Command – By running the Utilization Command to reveal how well the software utilizes the CPU to understand the bottlenecks.
4. Duration Command – To focus on the computational process of the program, this command delays the start of process to help with the process creation time.