IIT Kharagpur

Parallel and Distributed Algorithms

CS60026

Programming Assignment 1

Ashish Manmode
12EC35006

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Contents

1 Objective

Matrix-Vector Multiplication on Sparse Matrices using different scheduling techniques.

2 Results

Below are the plots for no. of threads used vr. performance for three types of scheduling.

1. Static
2. Dynamic
3. Guided

2.1 Matrix 1

No. of Rows/Columns = 47300
No. of Non-Zero Elements = 390192

2.2 Matrix 2

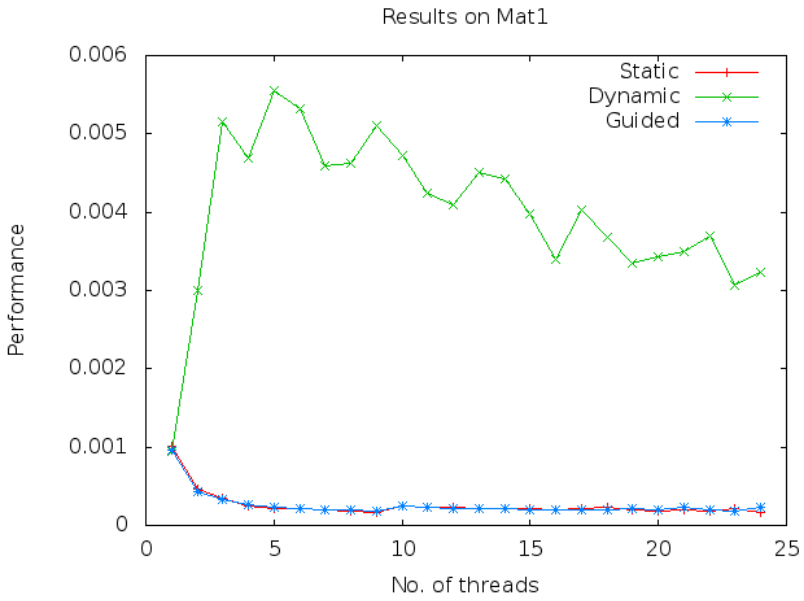
No. of Rows/Columns = 65086
No. of Non-Zero Elements = 461286

2.3 Matrix 3

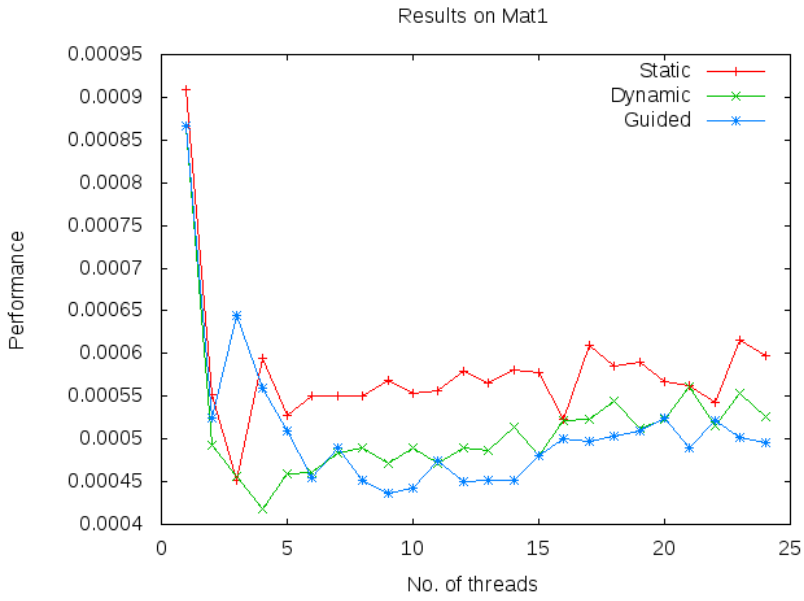
No. of Rows/Columns = 373315
No. of Non-Zero Elements = 7220836

2.4 Matrix 4

No. of Rows/Columns = 2096790
No. of Non-Zero Elements = 12720580

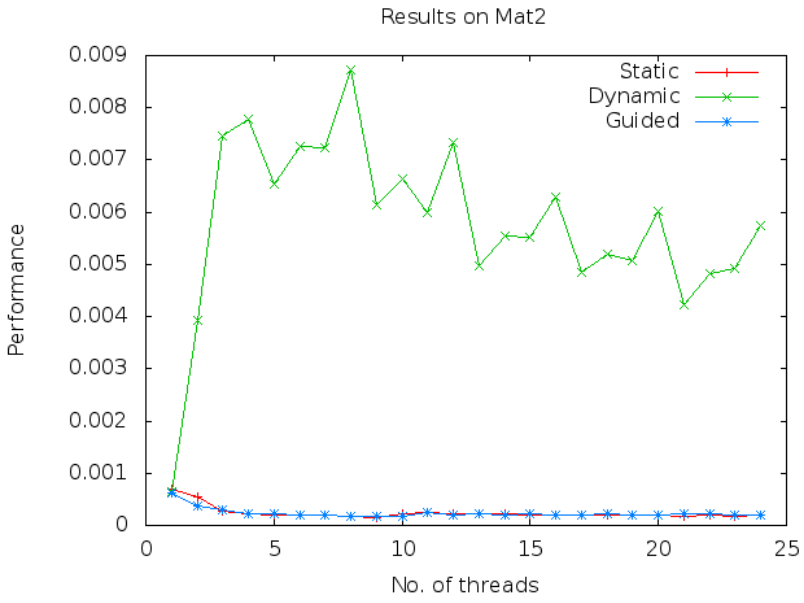


(a) For Dynamic : Chunk = 1

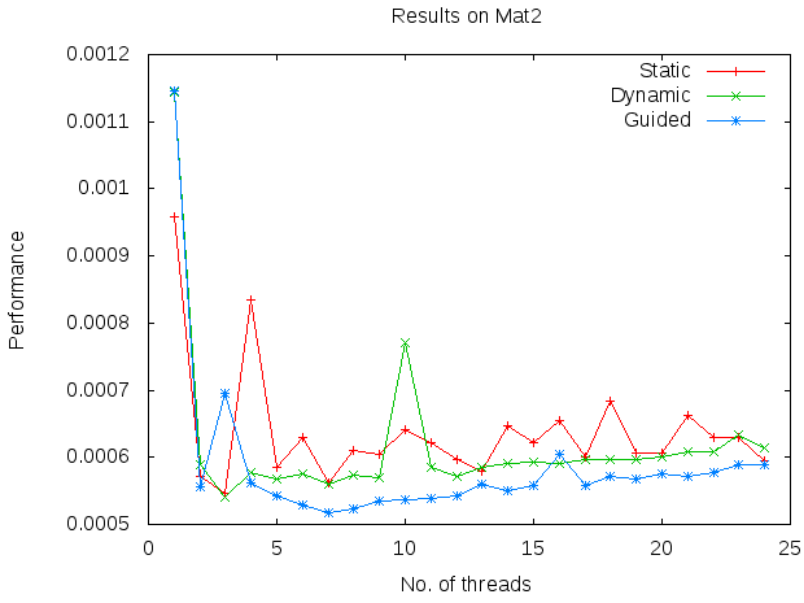


(b) For Dynamic : Chunk = 100

Figure 1: Matrix 1

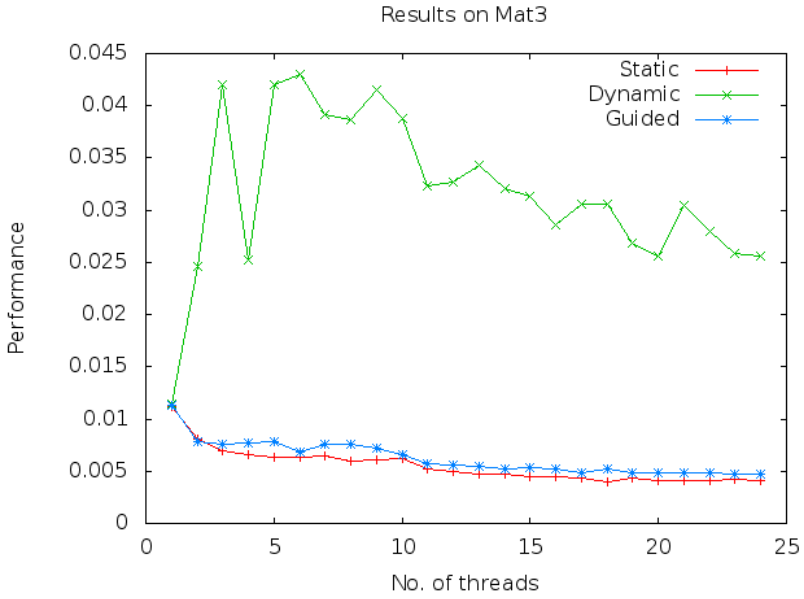


(a) For Dynamic : Chunk = 1

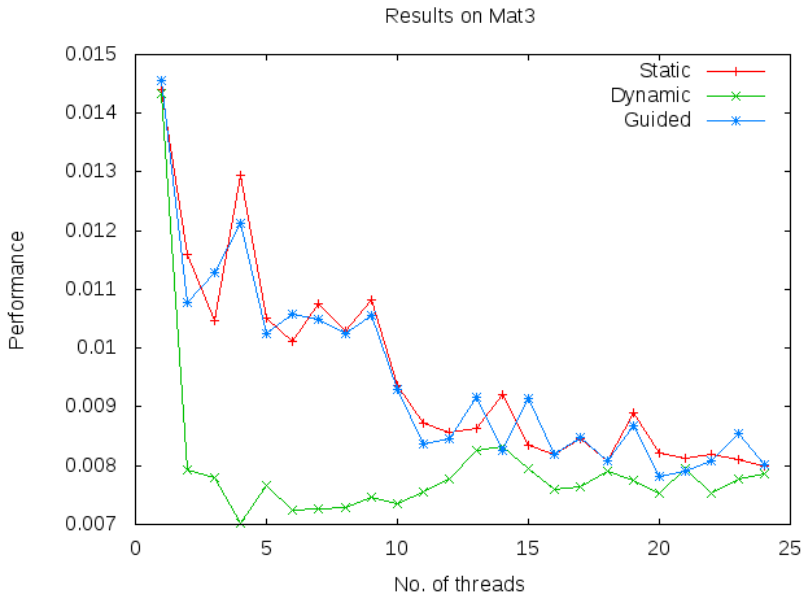


(b) For Dynamic : Chunk = 100

Figure 2: Matrix 2

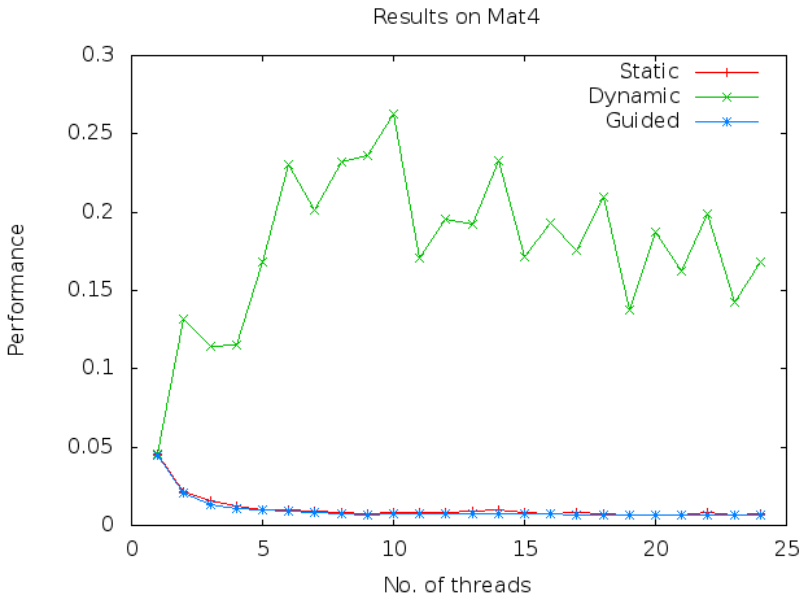


(a) For Dynamic : Chunk = 1

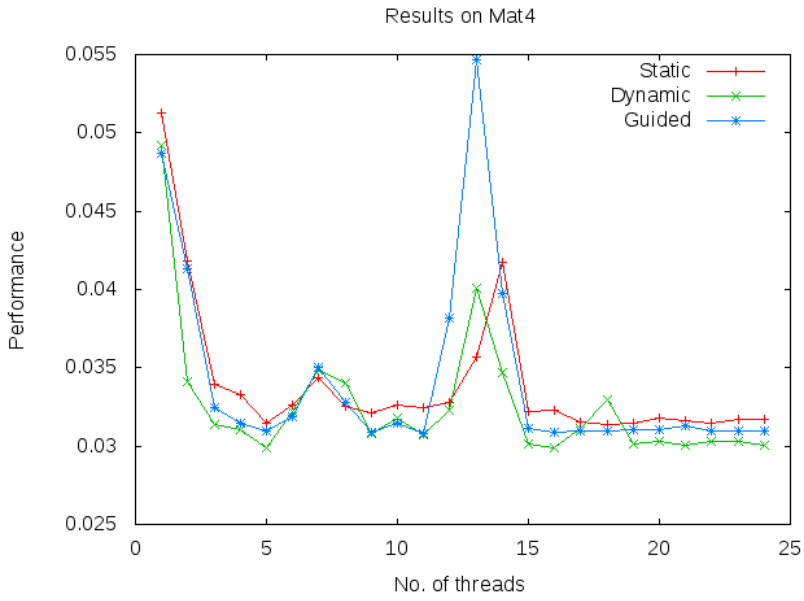


(b) For Dynamic : Chunk = 100

Figure 3: Matrix 3



(a) For Dynamic : Chunk = 1



(b) For Dynamic : Chunk = 100

Figure 4: Matrix 4

3 Evaluations

- For all the 4 matrices it was observed that Static scheduling and guided scheduling worked faster than dynamic scheduling (chunk = 1).
- The static scheduling works best when amount of work done in every iteration is same. This suggests that in every matrix no. of non-zero entries in each row were nearly same.
- So, in such case Dynamic scheduling will not give better results because there is work allocation overload after any of the thread is finished unlike static where it is already fixed.
- Again, Guided works as good as Static. In Guided Iterations are dynamically assigned to threads in blocks as threads request them until no blocks remain to be assigned. Similar to DYNAMIC except that the block size decreases each time a parcel of work is given to a thread. The size of the initial block is proportional to:
  number_of_iterations /number_of_threads
  Subsequent blocks are proportional to
  number_of_iterations_remaining /number_of_threads.
- Now when chunk size was set to 100 in case of dynamic scheduling the performance was a lot improved reasoning to letter allocation overhead.
- **Conclusion:** Found results suggests that non-zero entries in a row are nearly same. So, if a different sparse matrix is given the scaling performance in scheduling may differ.