CS6560 : Assignment 3

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1 OpenMp :

OpenMP is an Application Program Interface for shared memory parallel applications.

1.1 OpenMp constructs used :

- omp_set_num_threads(): the function sets number of threads in the following parallel region.
- omp_set_nested() : the function enable/disable the nested parallelism.
- #pragma omp parallel : Defines a parallel region that is a block of code that will be executed by multiple threads. it is the fundamental OpenMP parallel construct.
- #pragma omp for : specifies that the iterations of the loop immediately following it must be executed in parallel.
- Schedule : Describes how iterations of the loop are divided among the threads in the threads.
  - Static : Loop iterations are divided into pieces of size chunk and then statically assigned to threads.
  - Dynamic : Loop iterations are divided into pieces of size chunk, and dynamically scheduled among the threads, when a thread finishes one chunk, it is dynamically assigned another.
  - Guided : Loop 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.

2 Analyzing parallel program performances

2.1 Run Time for different Schedule

Below is the running time of the program A and B under various Schedule type in openmp i.e static, dynamic or guided.
N = 100000000
Chunk size = N is equally divided among threads.

2.1.1 For Program A

Static :

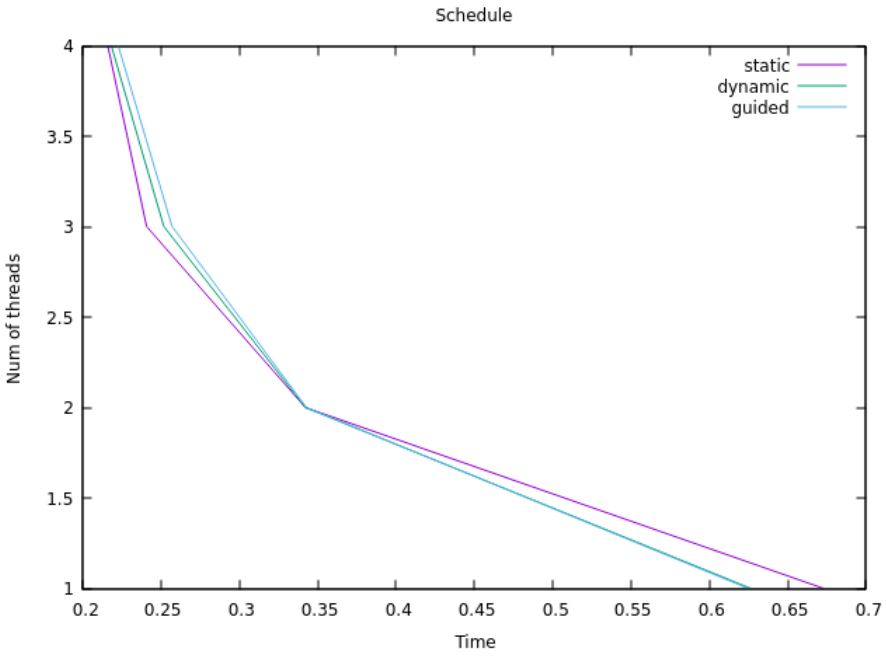
Thread Number	Time
1	0.672878
2	0.342187
3	0.240974
4	0.216221

Dynamic :

Thread Number	Time
1	0.626382
2	0.342168
3	0.252023
4	0.218553

Guided :

Thread Number	Time
1	0.624708
2	0.342877
3	0.257263
4	0.222884



GRAPH for Program A

2.1.2 For program B :

Static :

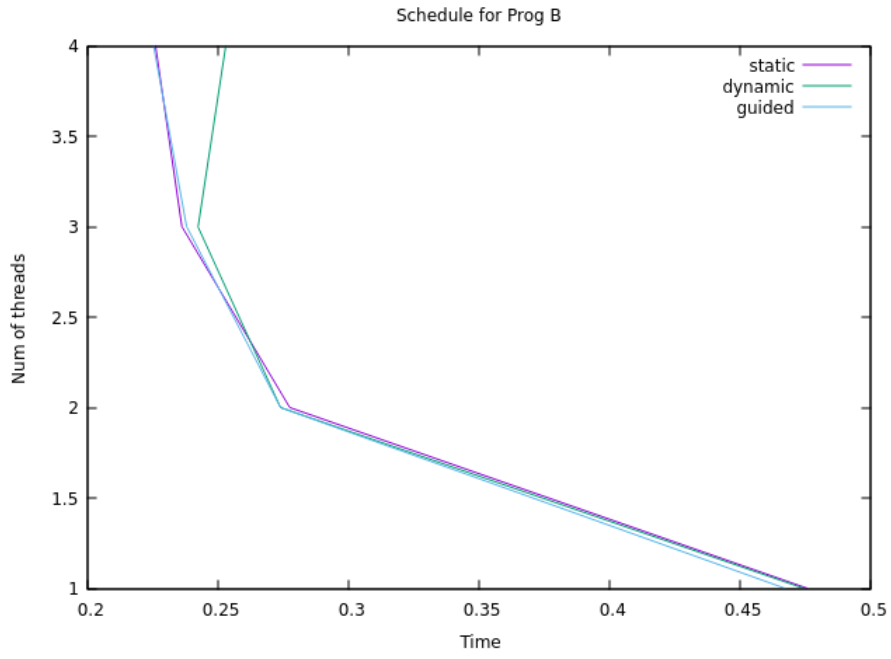
Thread Number	Time
1	0.475659
2	0.277407
3	0.236133
4	0.226071

Dynamic :

Thread Number	Time
1	0.474254
2	0.273875
3	0.242267
4	0.252879

Guided :

Thread Number	Time
1	0.467129
2	0.273894
3	0.237966
4	0.225352



GRAPH for Program B

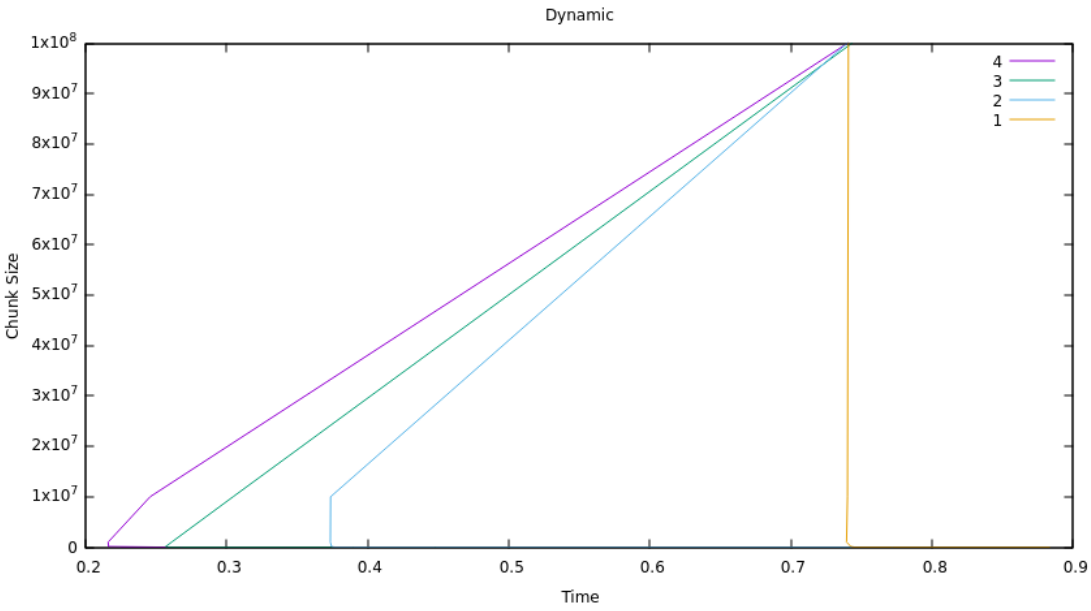
Inferences from data:

- With increase in number of threads the execution time decreases significantly until a thersold value after which increasing number of threads also increases the execution time.
- Dynamic vs Static : for lower number of threads dynamic scheduling does better but as we increase the number of threads the static has lower runtime.
- Guided is the optimal choice for schedluing as it performs better irrespective of number of threads.

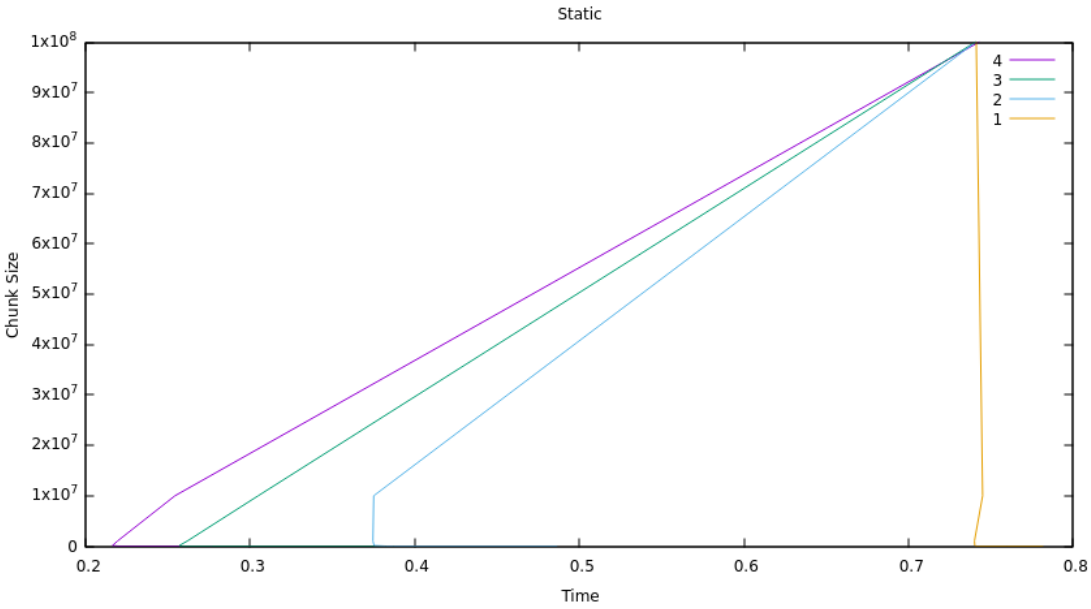
3 Chunk size vs Time vs Number of Thread

3.1 Program A :

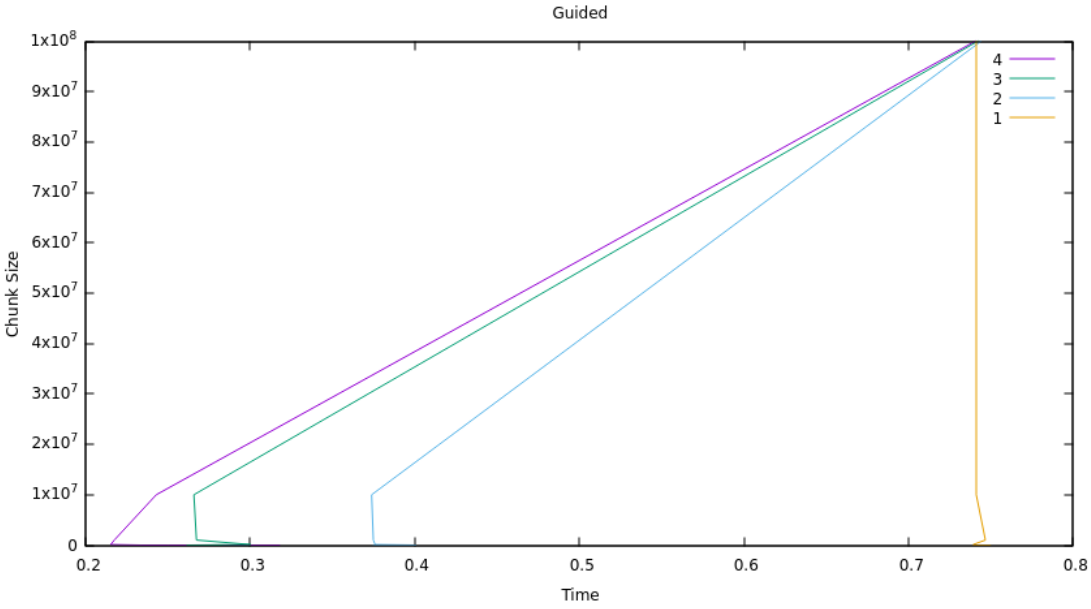
3.1.1 Dynmaic:



3.1.2 Static:

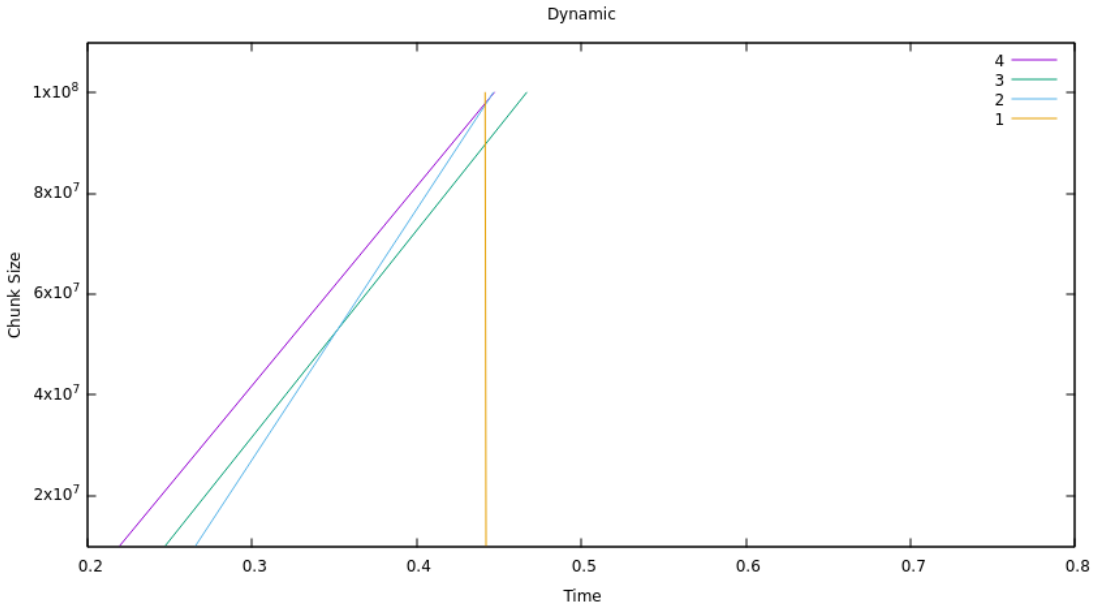


3.1.3 Guided:

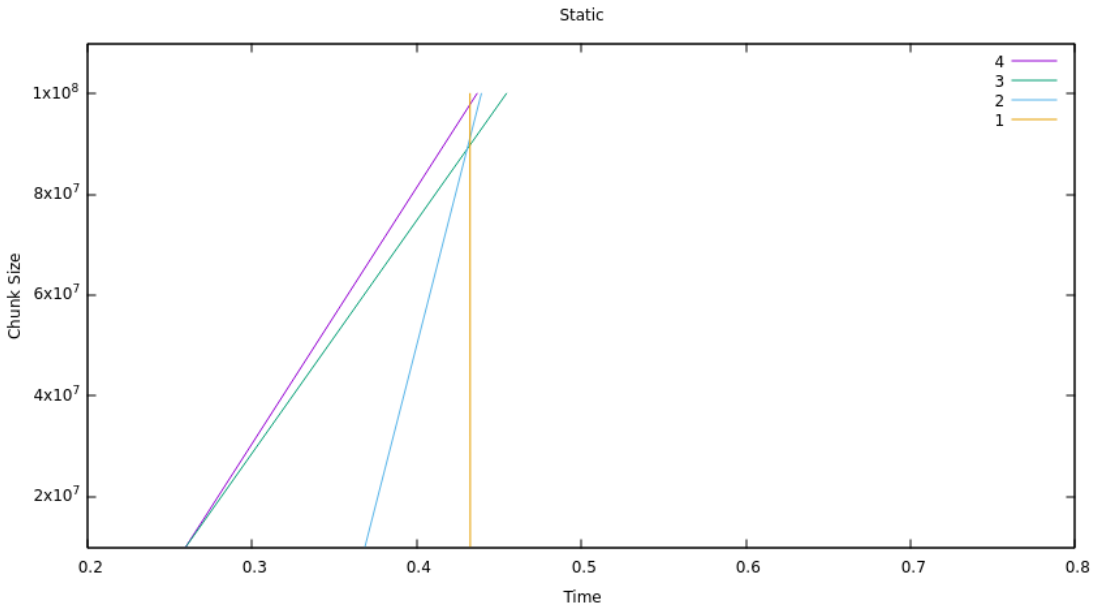


3.2 Program B :

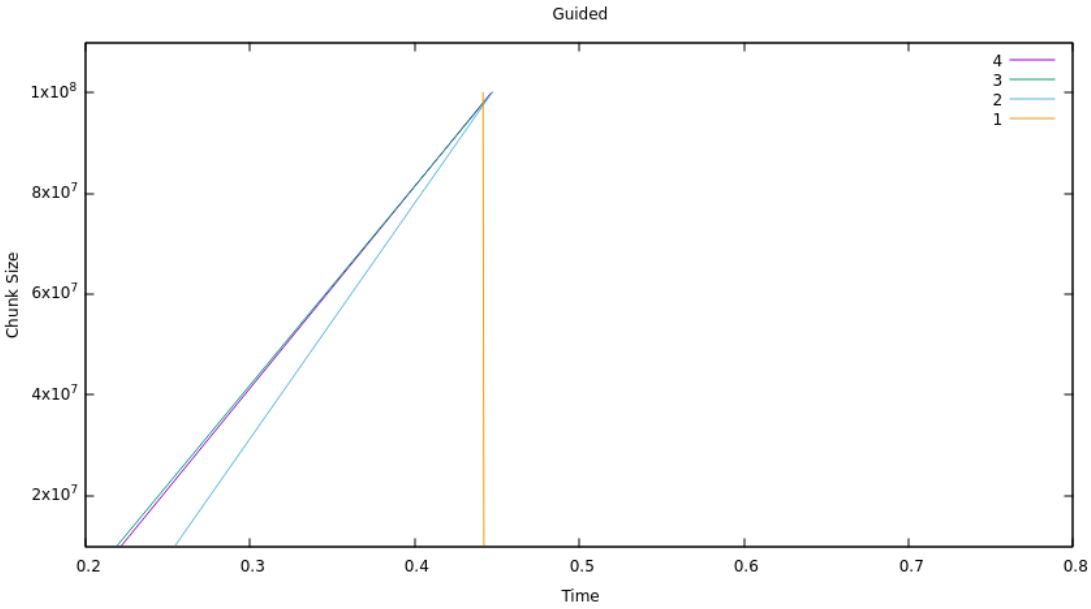
3.2.1 Dynmaic:



3.2.2 Static:



3.2.3 Guided:


Guided
Chunk Size
Time
4
3
2
1
1x10^8
8x10^7
6x10^7
4x10^7
2x10^7
0.2
0.3
0.4
0.5
0.6
0.7
0.8