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Assignment 2

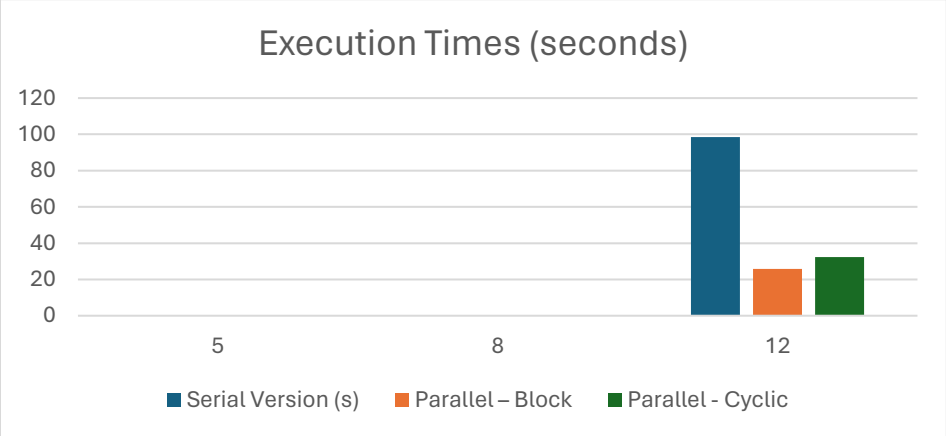
Section: A

Performance Evaluation:

The following table enlists execution times (in seconds) of serial and MPI based parallel versions with cyclic and block decompositions of the program for different sized graphs i.e., number of vertices/edges. Both directed and undirected dense graphs were used.

Note: Number of Processes used for cyclic metric are vertices/2.

No. of Vertices	Serial	Parallel – Block	Parallel - Cyclic
4	0.001	0.273	0.251
8	0.002	0.319	0.249
12	98.42	25.836	32.314



Speed Up Metrics:

Using Actual Speed up formula to calculate speedup of parallel version with block and cyclic decomposition of domain.

Data Size	Parallel - Cyclic	Parallel – Block
4	0.003	0.004
8	0.006	0.008
12	3.81	3.04

Analysis and Findings:

Execution Time:

For small graphs the serial version performs better than the parallel version due to lack of communication overheads. As the data size increases, these overheads become negligible as compared to execution time of the core algorithm which then results in parallel version being faster. This is because multiple instances of the same program are being executed across multiple systems simultaneously, each of which is exploring a unique and dedicated part of solution space.

Speed Up

The parallel version of the program offers exponential speedup as the size of the graph increases. This is because each process explores a unique part of the solution space with all processes running simultaneously.

Scalability:

From the above shown metrics, it is clear that as the data size increases the difference between the performance of serial and parallel versions also increases. This indicates that the parallel version of the program is more scalable. It must also be noted that the improvement offered by the parallel version relative to serial version is not linear and varies based on resources available at the time of execution as well as the nature of graph.

Decomposition Strategy:

The decomposition of solution space is implicitly dependent on the number of processes executing the program relative to number of vertices in graph. It may be noted that block decomposition of large datasets will provide better performance on dense graphs. Whereas cyclic decomposition may be preferred when few nodes are available, or graph is sparse.

Conclusion:

1. The serial version is faster on smaller graphs.
2. The parallel version is faster on larger graphs.
3. For smaller solution spaces, the serial version performs better due to lack of communication overheads.
4. As the solution space increases, parallel version shows exponential gains in speed over the serial version.
5. The parallel version is more scalable.