| Name: John Gabriel Buenaventura | Date: June 10, 2024 |
| --- | --- |
| Section: CS33S1 | Prof: Ma'am Janice |

# Parallel Algorithms

---

1. Parallel Algorithm

   A parallel algorithm is a method of computation in which many calculations or processes are carried out simultaneously, leveraging multiple processors to solve a problem more quickly than possible with a single processor. It divides a task into smaller subtasks, which are solved concurrently, and then combines their results.

2. Concurrent Processing

   Concurrent processing involves the execution of multiple sequences of operations or processes simultaneously, potentially interacting with each other. It is fundamental in operating systems and multitasking environments, enabling efficient use of system resources and improving responsiveness.

3. Multiprocessors

   Multiprocessors are computer systems with two or more central processing units (CPUs) that share access to the same memory and peripheral devices. They enhance computational power by allowing multiple CPUs to perform tasks concurrently, thereby speeding up processing and improving performance for complex computations.

4. Multicomputers

   Multicomputers, also known as loosely coupled systems, are made up of numerous separate computers that are connected over a network and each

have their own memory and operating system. They work together to tackle complex issues by dividing workloads and interacting across the network. Unlike multiprocessors, multicomputers do not share memory, making them scalable and appropriate for dispersed computing settings.

5. Distributed system

   A distributed system is a group of independent computers that appear to the user as a single coherent system, cooperating to achieve a common goal. These systems distribute resources, data, and computing power among several nodes, which may be placed in different physical locations.

6. Time Complexity

   Time complexity is a computational statistic that quantifies how long an algorithm takes to complete based on the size of the input. Big O notation (e.g., O(n), O(log n), and O(n^2) is commonly used to set an upper constraint on the runtime's growth rate in relation to the input size.

7. Data parallelism

   Data parallelism is a parallel computing paradigm in which the same operation is done simultaneously on multiple pieces of distributed data. It makes use of the several cores or processors available in modern computing systems to speed up data processing processes. By breaking a large dataset into smaller chunks, each processor can work on a subset of the data simultaneously, resulting in significant performance gains.

8. Hybrid algorithm model

   A hybrid algorithm model mixes many computational paradigms, such as sequential and parallel processing, or various forms of parallelism. This method seeks to maximize performance by resolving the constraints that come with using a single model. A hybrid algorithm might, for instance, combine task

parallelism for intricate operations and data parallelism for large-scale computations.

9. Point-to-Point Communication

   Point-to-point communication refers to a direct communication link between two nodes or processes in a network, without the involvement of intermediary nodes. It is a fundamental mechanism in distributed systems and parallel computing for data exchange and synchronization between processes.

10. Hypercube Network

    A hypercube network is a type of network topology used in parallel computing where each node is connected to others in a structure resembling an n-dimensional hypercube. In an n-dimensional hypercube, each node has n direct connections, linking it to other nodes that differ in exactly one binary digit in their address. This structure provides efficient routing and fault tolerance, as there are multiple paths between any two nodes, reducing the risk of communication bottlenecks.

References:

[1] Parallel Algorithm - Introduction. Tutorialspoint. (n.d.). https://www.tutorialspoint.com/parallel_algorithm/parallel_algorithm_introduction.html

[2] GeeksforGeeks. (2023, July 31). Parallel Algorithm Models in Parallel Computing. GeeksforGeeks. https://www.geeksforgeeks.org/parallel-algorithm-models-in-parallel-computing/

[3] GeeksforGeeks. (2022, June 16). Concurrent Processes in Operating System. GeeksforGeeks. https://www.geeksforgeeks.org/concurrent-processes-in-operating-system/

[4] Concurrent processing. (2015, July 10). AccessScience. https://doi.org/10.1036/1097-8542.155050

[5] GeeksforGeeks. (2024, May 13). Introduction of Multiprocessor and Multicomputer. GeeksforGeeks. https://www.geeksforgeeks.org/introduction-of-multiprocessor-and-multicomputer/

[6] Parthasarathi, R. (n.d.). Introduction to Multiprocessors – Computer Architecture. https://www.cs.umd.edu/~meesh/411/CA-online/chapter/introduction-to-multiprocessors/index.html

[7] GeeksforGeeks. (2024a, February 1). Difference Between Multiprocessor and Multicomputer. GeeksforGeeks. https://www.geeksforgeeks.org/difference-between-multiprocessor-and-multicomputer/

[8] Difference between Multiprocessor and Multicomputer System - javatpoint. (n.d.). www.javatpoint.com. https://www.javatpoint.com/difference-between-multiprocessor-and-multicomputer-system

[9] What is a distributed system? | Atlassian. (n.d.). Atlassian. https://www.atlassian.com/microservices/microservices-architecture/distributed-architecture

[10] GeeksforGeeks. (2024b, April 22). What is a Distributed System? GeeksforGeeks. https://www.geeksforgeeks.org/what-is-a-distributed-system/

[11] GeeksforGeeks. (2024b, April 22). Understanding Time Complexity with Simple Examples. GeeksforGeeks. https://www.geeksforgeeks.org/understanding-time-complexity-simple-examples/

[12] What is Time Complexity? Examples and Algorithms | 2024. (2024, April 29). Great Learning Blog: Free Resources what Matters to shape your Career! https://www.mygreatlearning.com/blog/why-is-time-complexity-essential/

[13] What Is Data Parallelism? (2024, February 9). Pure Storage. https://www.purestorage.com/knowledge/what-is-data-parallelism.html

[14] Talia, D., Trunfio, P., & Marozzo, F. (2016). Designing and Supporting Scalable Data Analytics. In Elsevier eBooks (pp. 77–122). https://doi.org/10.1016/b978-0-12-802881-0.00004-4

[15] Reddy, A. L. N., & Wyllie, J. (2002). https://doi.org/10.1016/b978-155860651-7/50146-7

[16] What is Hybrid Algorithm | IGI Global. (n.d.). https://www.igi-global.com/dictionary/particle-swarm-optimization-algorithm-its/13449

[17] Point to Point Communication Explained - melita.io. (2023, June 13). melita.io. https://www.melita.io/help/general-information/iot-wiki/point-to-point-communication-explained/

[18] Serpanos, D., & Wolf, T. (2011). Interconnects and switching fabrics. In Elsevier eBooks (pp. 35–61). https://doi.org/10.1016/b978-0-12-374494-4.00004-9

[19] GeeksforGeeks. (2024e, May 21). Hypercube Interconnection. GeeksforGeeks. https://www.geeksforgeeks.org/hypercube-interconnection/

[20] What is Hypercube Interconnection? (n.d.). https://www.tutorialspoint.com/what-is-hypercube-interconnection

Honor Pledge

"I affirm that I have not given or received any unauthorized help on this activity, and this work is my own."

- John Gabriel Buenaventura