

Graph Theory : Application in Computer Science

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Abstract: *Graph Theory is a fundamental branch of mathematics that has become an essential tool in many areas of computer science. It provides a powerful framework for representing and analyzing relationships between different entities using vertices (nodes) and edges (connections). Many complex computational problems can be effectively modeled and solved using graph-based techniques. In computer science, graph theory is widely applied in areas such as computer networks, data structures, database management, artificial intelligence, and social network analysis. It helps in solving problems related to path optimization, connectivity, resource allocation, and network design. Algorithms based on graph theory, such as Breadth-First Search (BFS), Depth-First Search (DFS), and shortest path algorithms, play a significant role in improving the efficiency and performance of modern computing systems. Graph structures are also used in search engines, recommendation systems, and knowledge representation models to analyze large-scale data and complex relationships. With the rapid growth of digital technologies and interconnected systems, the importance of graph theory in computer science continues to increase. This study highlights the key concepts of graph theory and explores its major applications in various computer science domains, demonstrating how it contributes to solving real-world computational challenges.*

Keywords: *Graph Theory, Computer Science Applications, Network Analysis, Graph Algorithms, Data Structures, Artificial Intelligence, Social Networks, Path Optimization*

