

UNIVERSITY INSTITUTE OF COMPUTING

MASTER OF COMPUTER APPLICATIONS

Design and Analysis of Algorithms

24CAT-611

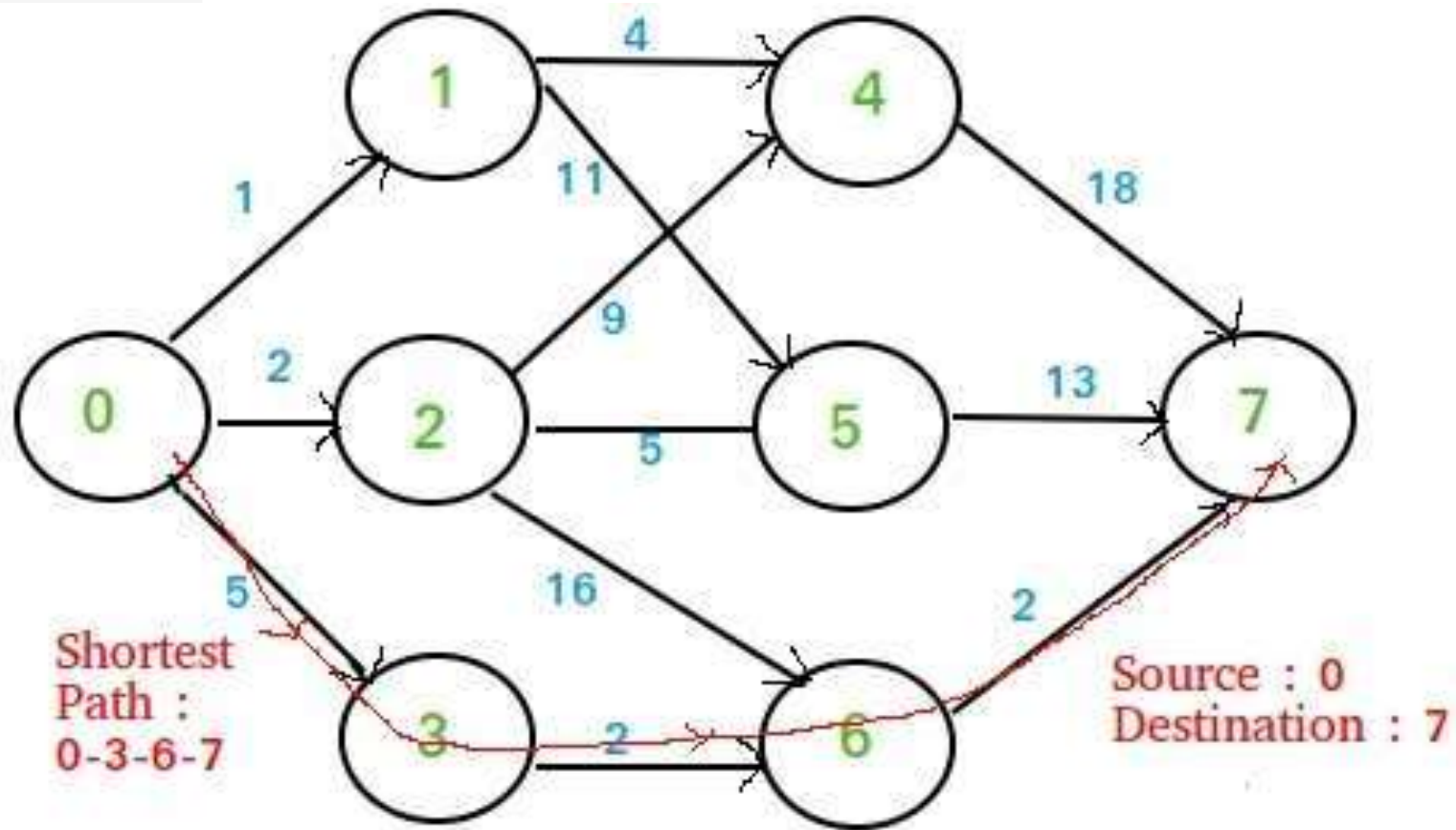


DISCOVER . LEARN . EMPOWER

Multi-Stage Graph

- • A **Multistage graph** is a directed graph.
- • The nodes can be divided into a set of stages.
- • All edges from a stage to next stage .
- • There is no edge between vertices of same stage .
- • A vertex of current stage to previous stage
- • A multistage graph, a source and a destination, we
- need to find shortest path from source to destination.

Multistage Graph



VARIOUS STRATEGIES

- : The **Brute force** method of finding all possible paths between Source and Destination.
- • **Dijkstra's Algorithm** has a Single Source shortest paths.
- • This method will find shortest paths from source to all other nodes which is not required.
- • It will take a lot of time and it doesn't even use the SPECIAL feature that this MULTI-STAGE graph.

Simple Greedy Method

At each node, choose the shortest outgoing path.

- we apply this approach to the example graph give above we get the solution as $1 + 4 + 18 = 23$.
- But a quick look at the graph will show much shorter paths available than 23. So the greedy method fails.
- The best option is Dynamic Programming.
- To find **Optimal Sub-structure, Recursive Equations and Overlapping Sub-problems.**

BASIC TRAVERSAL AND SEARCH TECHNIQUES

- Traversal of a binary tree involves examining every node in the tree.
- Search involves visiting nodes in a graph in a systematic manner, and may or may not result into a visit to all nodes.
- Different nodes of a graph may be visited, possibly more than once, during traversal or search.
- If search results into a visit to all the vertices, it is called traversal.

TECHNIQUES FOR BINARY TREES

- Determine a vertex or a subset of vertices that satisfy a specified property .
- **Possible problem:**
 - ❖ Find all nodes in a binary tree with data value less than some specified value .
 - ❖ Solved by systematically examining all the vertices
 - ❖ Does searching for a specified item in a binary search tree result into a traversal.

TECHNIQUES FOR GRAPHS

Reachability problem in graph theory.

- Determine whether a vertex v is reachable from a vertex u in a graph $G = (V, E)$.
- Whether there exists a path from u to v .
- A more general form:
- Given a vertex $u \in V$, find all vertices $v_i \in V$ such that there is a path from u to v_i .
- Solved by starting at vertex u and systematically searching the graph G for vertices reachable from u .
- Breadth first search and traversal

TECHNIQUES FOR GRAPHS

- ❖ Explore all vertices adjacent from a starting vertex.
- ❖ A vertex is said to be explored when the algorithm has visited all the vertices adjacent from it.
- ❖ As a vertex is reached or visited, it becomes a new unexplored vertex.
- ❖ Explore unexplored vertices that are adjacent to all the explored vertices.
- ❖ Breadth-first search operates using a queue to maintain the list of unexplored vertices.

References

- 1) https://www.tutorialspoint.com/data_structures_algorithms/divide_and_conquer.htm
- 2) **Data Structures and Algorithms made easy By Narasimha Karumanchi.**
- 3) **The Algorithm Design Manual, 2nd Edition by Steven S Skiena**
- 4) **Fundamentals of Computer Algorithms - Horowitz and Sahani**



THANK YOU