Algorithm Coursework 30-03-2020

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Contents

Algorithmic Strategy, Data Structure & Traversal

The coursework speaks about the maximum flow problem. There are many ways this could be implemented (Greedy, Ford-Fulkerson, etc….). For this purpose, Ford-Fulkerson Breadth First Search Algorithm (Edmonds-Karp Algorithm) is used. The idea is that with this methodology Breadth First Search picks a path with minimum number of edges. Ford-Fulkerson method has no strict traversal solutions to be implemented. It's up to us to decided it according to the situation.

The following implementation uses an adjacency matrix representation because it's easier to implement and follow. Removing and edge takes O(1) time. Queries like whether there is an edge from vertex 'u' to vertex 'v' are efficient and can be done O(1). However, the representation consumes more space O(V^2). Even if the graph is sparse (contains less number of edges), its consumes the same space while adding a vertex is also O(V^2) time.

Pseudocode: Ford-Fulkerson Algorithm

1. Start with initial flow as 0
2. While there is an augmenting path from source to sink
    a. Add this path-flow to flow
3. Return flow

Analysing the Algorithm

The time complexity of the above algorithm is O(max_flow*E). We run a loop while there is an augmenting path. In worst case, we may add 1-unit flow in every iteration. Therefore, the time complexity becomes O(max_flow*E). When BFS is used, the worst-case time complexity can be reduced to O(VE2).

No. of Nodes	S -> T	Max Flow	Time Taken (Seconds)
6	1 - 6	15	0.0
12	1 - 12	38	0.003
24	1 - 24	26	0.003
48	1 - 48	33	0.003
96	1 - 96	35	0.015

References

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