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A Study on Network Flow and Finding Maximum Flow Using Ford-Fulkerson Algorithm

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ABSTRACT

Ford-Fulkerson algorithm is widely used to solve maximum Graph-Flow problems and it can be applied to a range of different areas, including networking. This project proposes an approach based on Ford-Fulkerson algorithm to maximize the flow of computer network. Such method mitigates congestion problems and increases network utilization. In order to show the applicability of the proposed approach, this project presents the analysis of network scenarios.
Keywords : Network Flow, Residual Network, Residual Capacity, Augmenting Path.

I. INTRODUCTION

Network flow is an advanced branch of graph theory. The problem resolves around a special type of weighted directed graph with two special vertices: the source vertex, which has no incoming edge, and the sink vertex, which has no outgoing edge. By convention, the source vertex is usually labelled s and the sink vertex labelled t. The story usually go like this: there are a bunch of junctions (nodes in the graph) and a bunch of pipes (edges in the graph) connecting the junction. The pipe will only allow water to flow one way (the graph is directed). Each pipe has also has a capacity (the weight of the edge), representing the maximum amount of water that can flow through the pipe. Finally, we pour an infinite amount of water into the source vertex. The problem is to find the maximum flow of the graph - the maximum amount of water that will flow to the sink.

Ford-Fulkerson Algorithm

Input : Given a Network G and consider its flow capacity is *c*, a source is defined by *s*, and a sink is defined by *t*

Output : Compute a flow *f* from *s* to *t* of maximum value f =0

While (G_f contains an augmenting path P in G_f{

Identify an augmenting path P in G_f;

$\delta = min\{ C_{f(u,v)} / (u,v) \in P \}$

augment δ *unit flow along P & update* G_f;

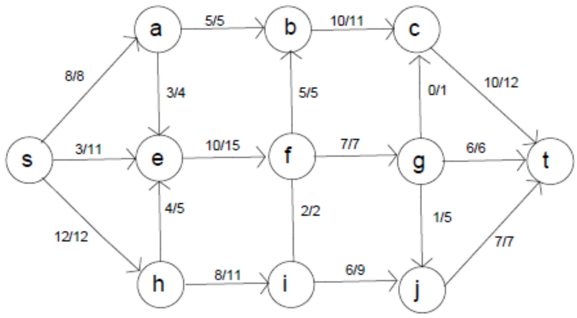
}

Recover max flow from the final residual network.

TO FIND THE MAXIMUM FLOW IN THE GIVEN NETWORK USING

FORD -FULKERSON ALGORITHM

A flow of value 23 in this network is shown. s and t are source and sink vertices. Using the flow conservation rule, the direction of every edge is found.



IfI =23

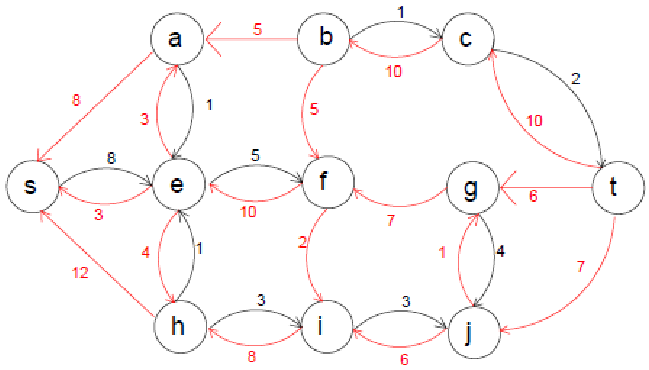
By using Ford-Fulkerson algorithm the residual network of the given graph is found.

Flow conservation rule:

Nodes other then s and t	Amount of flow come in	Amount of flow Go out	Should be equal
A	8	5+3	=
B	10	10	=
C	10	10	=
C or	10	0+10	=
E	3+3+4	10	=
H	12	4+8	=
F	12	7+5	=
I	8	2+6	=
J	6+1	7	=
G or	7+0	6+1	=
G	7	0+6+1	=

2) Draw a residual network with respect to given flow.

Residual Network



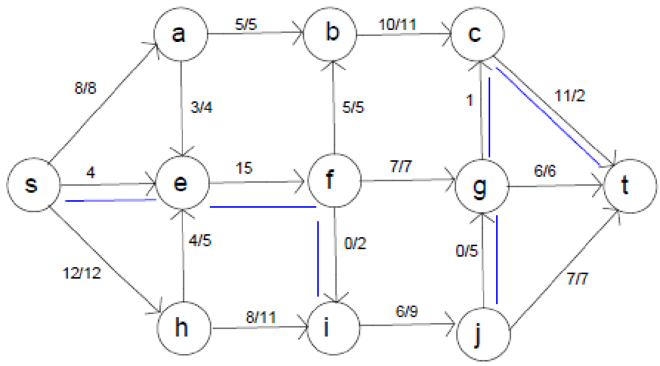
If p be the path s,e,f,i,j,g,c,t in it.

Given p=(s,e,f,I,j,g,c,t)

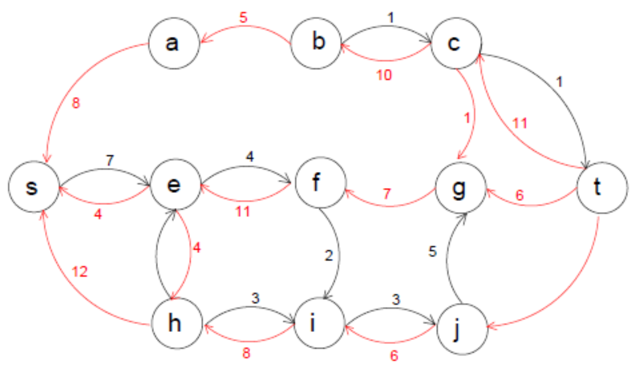
δ (p)= min (8,5,2,3,1,1,2)

δ (p)= 1

From the flow network given above, we find out δ (p) units of additional flow using path p=(s,e,f,i,j,g,c,t) and the resulting flow is 24.



To check whether the resulting flow is a maximum flow we have to find the residual network.



Let us find an augmenting path.
There is no augmenting path from s to t.
Hence the maximum flow is 24.

II. REFERENCES

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