MATHEMATICAL MODELING ON NETWORK FRACTIONAL ROUTING THROUGH INEQUALITIES

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***Abstract* – A Network is a set, directed, acyclic multigraph over which messages can be transmitted from source node to sink node. Linear programming is one of the most important optimization techniques to help decision making in network. The linear programming problem calls for optimising linear functions of variables called objective function, subject to a set of linear equations and /or inequalities called constraints. The objective function maximize either the total out-flow from source node or total in-flow to sink node. We will prove fractional routing capacity for some solvable network using inequalities model.**

Keywords: capacity, flow, fractional routing, inequalities

I. INTRODUCTION

The maximum flow problem can be solved by inequalities method. All the constraints are equations. All the variables are nonnegative. Network Fractional Routing has been proved to be an effective technology in solving network information flow problem, for each source nodes, the messages it transmits through intermediate nodes to target nodes through edge set. For each target node t, the message it requires is a subset of messages from source nodes. The intermediate nodes can not only duplicate and forward messages they receive from in-edges, but also use mathematical functions to compute these messages before forwarding them. If we can find a set of divergence functions which help satisfy all target nodes, then we say this network is solvable and we have found a solution for it. If messages transmitted in edges are scalar quantities, we call this solution scalar solution. If output message of each intermediate node is one of its incoming messages, we call this solution Routing Solution.

II. RELATED WORK

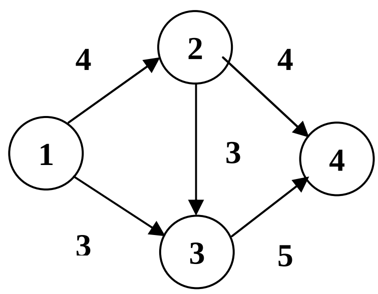

Fig.1. Capacity Diagram

Minimum Cut Problem:

A partition of the nodes into two sets S and T. The origin node must be in S and the destination node must be in T. Examples of cuts in the above network are

$S_1 = \{1\}$, $T_1 = \{2, 3, 4\}$

$S_2 = \{1, 2\}$, $T_2 = \{3, 4\}$

$S_3 = \{1, 2, 3\}$, $T_3 = \{4\}$

The value of a cut V (S_1, T_1) is the sum of all the arc capacities that have their tails in S and their heads in T.

V (S_1, T_1) = {(1, 2) + (1, 3) + (1, 4)}

= 4+3+0

V (S_1, T_1) = 7

The value of a cut V (S_2, T_2) is the sum of all the arc capacities that have their tails in S and their heads in T.

V (S_2, T_2) = {(1, 3) + (1, 4) + (2, 3) + (2, 4)}

= 3+0+3+4

V (S_2, T_2) = 10

The value of a cut V (S_3, T_3) is the sum of all the arc capacities that have their tails in S and their heads in T.

V (S_3, T_3) = {(1, 4) + (2, 4) + (3, 4)}

= 0+4+5

V (S_3, T_3) = 9

The maximum flow = min {V (S_1, T_1), V (S_2, T_2), V (S_3, T_3)}

= min {7, 10, 9}

The maximum flow = 7

The value of the Maximum Flow is equal to the value of the minimum cut.

III. PROPOSED ALGORITHM

Step1: Select the path from source to sink node with positive flow.

Step2: Let x_{ij} as the amount of flow in arc (i, j)

Step3: Let C_{ij} be the capacity of the same arc (i, j)

Step4: Assume that *s* and *t* are the source and sink nodes.

Step5: To determine the maximum flow in the capacity Network. The constraints of the problem preserve the In-Out flow at each node with the exception of start and terminal nodes.

Step 6: The objective of the function maximizes either the total flow from source node *s* or the total inflow to sink node *t*.

Step 7: Find f1. Let N = (Selected path from source to destination)

Where f1 = min (C1, C2, C3 ……. Cn)

Step 8: Find the maximum flow

Maximize z = f

Subject to

Find the flow of amount using inequalities

Flow In – Flow Out = 0

f = f1 + f2 + f3+ …..+ fn

f1 $\leq$ C1,

f2 $\leq$ C2,

f3 $\leq$ C3,

….

Fn $\leq$ Cn.

where flow $\leq$ Capacity

Step 9: Max z = Total out flow from Source Node or Total Inflow from Sink Node.

Step 10: Find the optimal solution using either objective function. The associated maximum flow value is z = f.

Step 11: Sum of the flow values f = f1 + f2 + ……fn.

Step 12: Network Fractional Routing = flow / capacity.

IV. DIVERGENCE SYSTEM FRACTIONAL ROUTING EXAMPLE

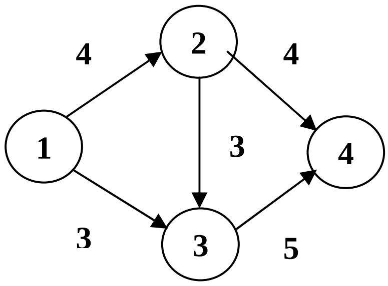

Fig.2. Capacity Diagram

Iteration 1:

Step 1: Select the path from source to sink node.

The path is $\mathbf{1 \longrightarrow 2 \longrightarrow 4}$

Step 2: The maximum flow f1 = min {4, 4}

Step 3: Send f1 = 4 unit along this path

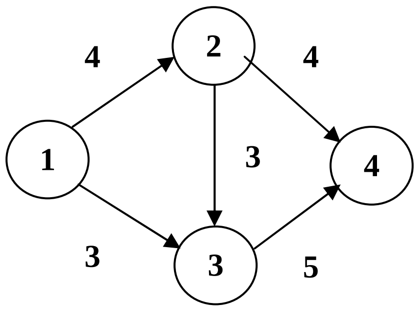

Fig.3. Flow & Capacity Diagram

Iteration 2:

Step 1: Select the path from source to sink node.

The path is $\mathbf{1 \longrightarrow 3 \longrightarrow 4}$

Step 2: The maximum flow f2 = min {3, 5}

Step 3: Send f2 = 3 unit along this path

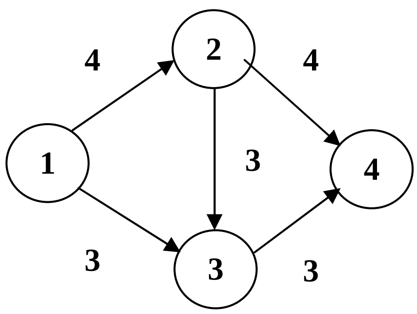

Fig. 4. Flow & Capacity Diagram

Iteration 3:

Step 1: Select the path from source node to sink node.

The path is $1 \longrightarrow 2 \longrightarrow 3 \longrightarrow 4$

Step 2: The maximum flow f3 = min {0, 3, 2}

Step 3: Send f3= 0 unit along this path

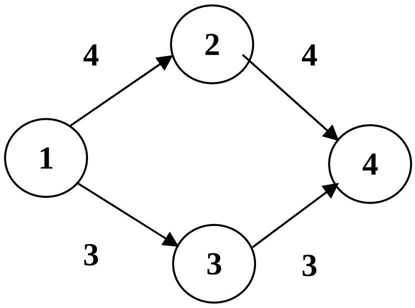

Fig. 5. Flow diagram

Iteration 4:

The objective is

Maximize z = f

Subject to

$$f = f1 + f2$$
$$f1 = f3 + f4$$
$$f2 + f3 = f5$$
$$f4 + f5 = f$$

where $f1 \leq 4$,

$f2 \leq 3$,

$f3 \leq 3$,

$f4 \leq 4$,

$f5 \leq 5$

Where f1 = 4, f2 = 3, f3 = 0, f4 = 4, f5 = 3

Max flow = f1 + f2

= 7

f1 = f3 + f4

= 4

f2 + f3 = f5

= 3

f4 + f 5 = f

= 7

The maximum flow = 7.

The value of the Maximum Flow is equal to the total outflow from source node or the total inflow from sink node.

V. RESULT AND DISCUSSION

Fractional Routing = flow / capacity.

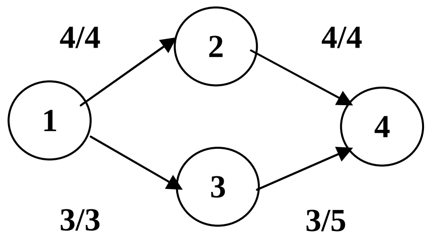

Fig.6. Fractional Routing diagram

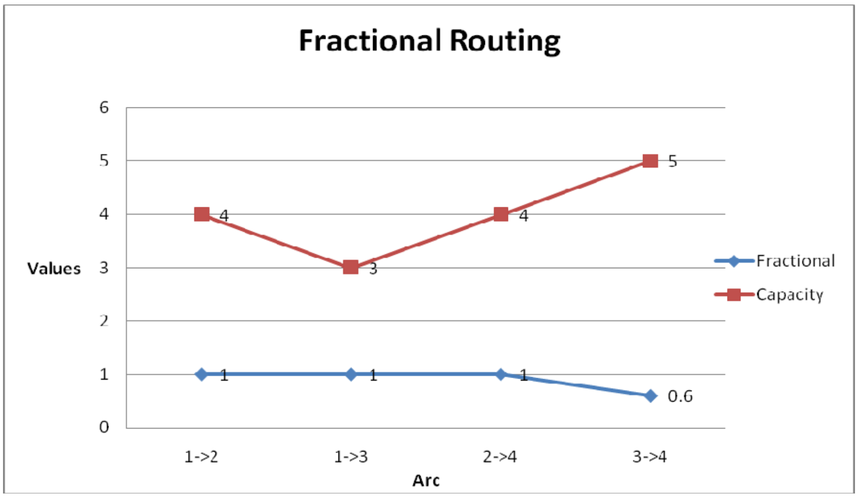

Fig.7. Network Fractional Routing

Fig.7. depicts the Fractional Routing values are lies between 0 and 1.

The purpose of this analysis is to reduce the computational time required to obtain the changes in the optimal solution. The linear variation in objective function coefficients and the variation in resources availability. The network inequalities can be used to determine the routing capacity of a network.

VI. CONCLUSION

A routing solution is also a linear solution. The objective function maximizes either the total out-flow from source node or the total in-flow to sink node. A set of inequalities which are satisfied by any minimal Fractional Routing solution is formulated. The maximum flow problem is a special case of more complex network flow problem. The max-flow values of quantities with multiple constraints. The routing capacity of every nondegenerate network is reachable.

VII. FUTURE WORK

This network has a linear coding solution but no routing solution. Inequalities are a mathematical technique of optimization using multistage decision process. It provides a systematic procedure for determining the combination of decisions which maximize overall effectiveness. The routing capacity of every network is balanced. We will briefly describe some of the algorithm for solving Non Deterministic Finite Automata.

VIII. REFERENCES

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