Mathematical Modeling on Network Fractional Routing Through Derivation Tree

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Abstract—A Derivation Tree is one of the most important optimization techniques to help decision making in Network. A Derivation Tree problem calls for optimizing linear functions of variables called objective function. The objective function minimizes the total overflow from source node to sink node. We will prove fractional Routing Capacity for some solvable network using Derivation Tree.

Keywords - capacity, flow, fractional routing, Derivation Tree.

I. INTRODUCTION

The maximum flow problem can be solved by Derivation Tree. 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, 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 Derivation Tree functions which help satisfy all target nodes, then this network is solvable and found a solution for it. If output message of each intermediate node is one of its incoming messages, then it called as Routing Solution.

II. RELATED WORK

Minimum Cut Problem

A portion of the node into two sets S and T. The origin node must be in S and the Derivation node must be in T.

Example.

Where S\textsubscript{1} = \{1\} and T\textsubscript{1} = \{2,3,4\}

V(S\textsubscript{1},T\textsubscript{1}) = \{(1,2) + (1,3) + (1,4)\}

= (4+3+0)

= 7

Where S\textsubscript{2} = \{1,2\} and T\textsubscript{2} = \{3,4\}

V(S\textsubscript{2},T\textsubscript{2}) = \{(1,3) + (1,4) + (2,3) + (2,4)\}

= (3+0+3+4)

= 10

Where S\textsubscript{3} = \{1,3\} and T\textsubscript{3} = \{2,4\}

V(S\textsubscript{3},T\textsubscript{3}) = \{(1,2) + (1,4) + (3,2)+(3,4)\}

Fig. 1. Capacity Diagram
\[
= (4+0+0+5) \\
= 9
\]
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 Maximum flow is equal to the value of Minimum Cut.

III. PROPOSED ALGORITHM

Step 1: Select the path from initial state to Final State with positive flow using Derivation Tree
Step 2: Find the Left Most Derivation And The Right most Derivation Tree from the Grammar.
Step 3: Find the Equivalent States from Derivation Tree
Step 4: Consider every state pair \((Q_i, Q_j)\) in the Transition Table where \(Q_i\) belongs to F and \(Q_j\) is not belongs to F.
Step 5: Merge the Equivalent States except Starting Node and Final Node.
Step 6: Finally, the Left most Derivation Trees And the Right Most Derivation Trees are optimal solution.

IV. FRACTIONAL ROUTING EXAMPLE

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Nodes</th>
<th>Arc</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node 1</td>
<td>1-&gt;2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1-&gt;3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Node 2</td>
<td>2-&gt;3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2-&gt;4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Node 3</td>
<td>3-&gt;4</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Node 4</td>
<td></td>
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</tbody>
</table>

Step 2:
Sort by Distance using the capacity.

<table>
<thead>
<tr>
<th>Arc</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-&gt;3</td>
<td>3</td>
</tr>
<tr>
<td>2-&gt;3</td>
<td>3</td>
</tr>
<tr>
<td>1-&gt;2</td>
<td>4</td>
</tr>
<tr>
<td>2-&gt;4</td>
<td>4</td>
</tr>
<tr>
<td>3-&gt;4</td>
<td>5</td>
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</tbody>
</table>

Step 3:
Connect all the vertices using minimum edges.

<table>
<thead>
<tr>
<th>Arc</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-&gt;3</td>
<td>3 (Accept)</td>
</tr>
<tr>
<td>2-&gt;3</td>
<td>3 (Accept)</td>
</tr>
<tr>
<td>1-&gt;2</td>
<td>4 (Reject)</td>
</tr>
<tr>
<td>2-&gt;4</td>
<td>4 (Accept)</td>
</tr>
<tr>
<td>3-&gt;4</td>
<td>5 (Reject)</td>
</tr>
</tbody>
</table>

Fig.2. Flow Diagram
Step 4:
Find the Derivation Tree.

\[ \text{The maximum flow} = \{V(1,2) \cup V(1,3)\} + \{V(2,4) \cup V(3,4)\} \]
\[ = \{3 \cup 3\} + \{4 \cup 4\} \]
\[ = 3 + 4 \]
\[ = 7 \]

The value of the Maximum Flow is equal to the total outflow from source node or the total inflow from the sink node. The meaningful objective of this problem is to determine the maximum flow of fluid from a given source node to a given sink node.

The Maximum Flow = 4 + 3 = 7

The value of the Maximum flow is equal to the total outflow from source node or the total inflow from the sink node. The meaningful objective of this problem is to determine the maximum flow of fluid from a given source node to a given destination node.

V. RESULT AND DISCUSSION

Fractional Routing = Flow / Capacity

The given production is
1->2 | 3
2->4
3->4

Fig.5. Network Fractional Routing
The fractional Routing values are lies between 0 and 1. The Derivation Tree used to determine the routing capacity of a Network. The purpose of this analysis is to reduce the nodes time required to obtain the changes in the optimal solution.

VI. CONCLUSION

The objective function minimizes the total outflow from initial node or the total inflow to final node. A set of nodes 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 value of quantities with multiple constraints. A multicast network that has a solution for a given alphabet might not have a solution for all larger alphabets. The routing capacity of every nondegenerate network is reachable. Finally, the Derivation Tree diagram changes without node.

VII. FUTURE WORK

The Derivation Tree is a mathematical technique of optimization using State Elimination. Every solvable multicast network has a scalar linear solution over a sufficiently large finite field alphabet. The Routing capacity of every network is balanced nondegenerate network is reachable. We will briefly describe some of the algorithm for solving Assignment problem.

REFERENCES