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Programming Assignment

Signal Flow Graph

Problem Statement:

Given:

Signal flow graph representation of the system. Assume that total number of nodes and numeric branches gains are given.

Required:

1- Graphical interface.
2- Draw the signal flow graph showing nodes, branches, gains, …
3- Listing all forward paths, individual loops, all combinations of n non-touching loops.
4- The values of □, □1, …, □m where m is number of forward paths.
5- Overall system transfer function.

Main Features:

- The program draws the signal flow graph showing all nodes. Branches and gains as given by the user.
- The program lists all forward paths, individual loops, all combinations of n non-touching loops.
- The program gives the overall transfer function.
- The program gives the values of □, □1, …, □m where m is number of forward paths.

Data Structure Used:

- Linked list of maps of all branches where each map has the input node of a branch, the output node and the gain.

- Linked list of all drawn nodes to make sure no to draw a node more than once.
- Array list of arrays to store all non-touching loop combinations.
- Array list of array lists to store all forward paths.
- Array list of array lists to store all loops.

Main modules:

1) **Application module:**
   This module contains the GUI controller class and the SignalFlowGraph class which are used to take commands from the user, store inputs and draw the signal flow graph diagram.
2) **Logic module:**
   This module holds all classes that are used to calculate the lists of all forward paths, individual loops, all combinations of non-touching loops, the overall transfer function and the values of the deltas.

Algorithms used:

- DFS algorithm is used to calculate all forward paths and the gains.

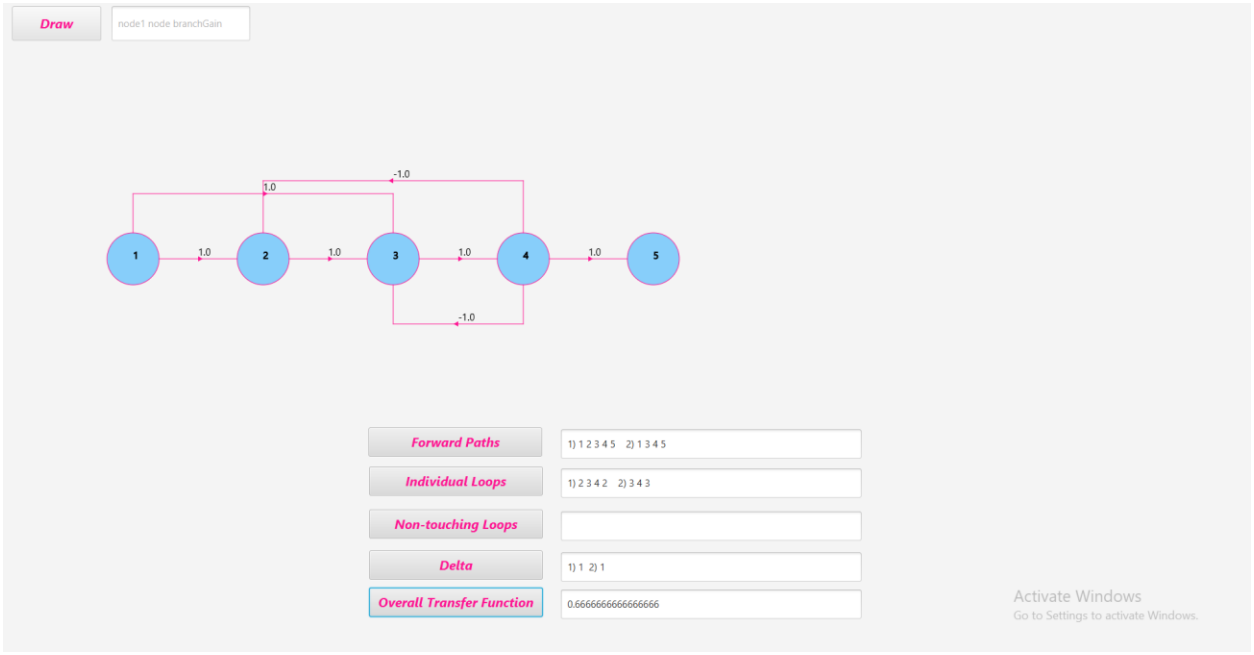
Simple user guide:

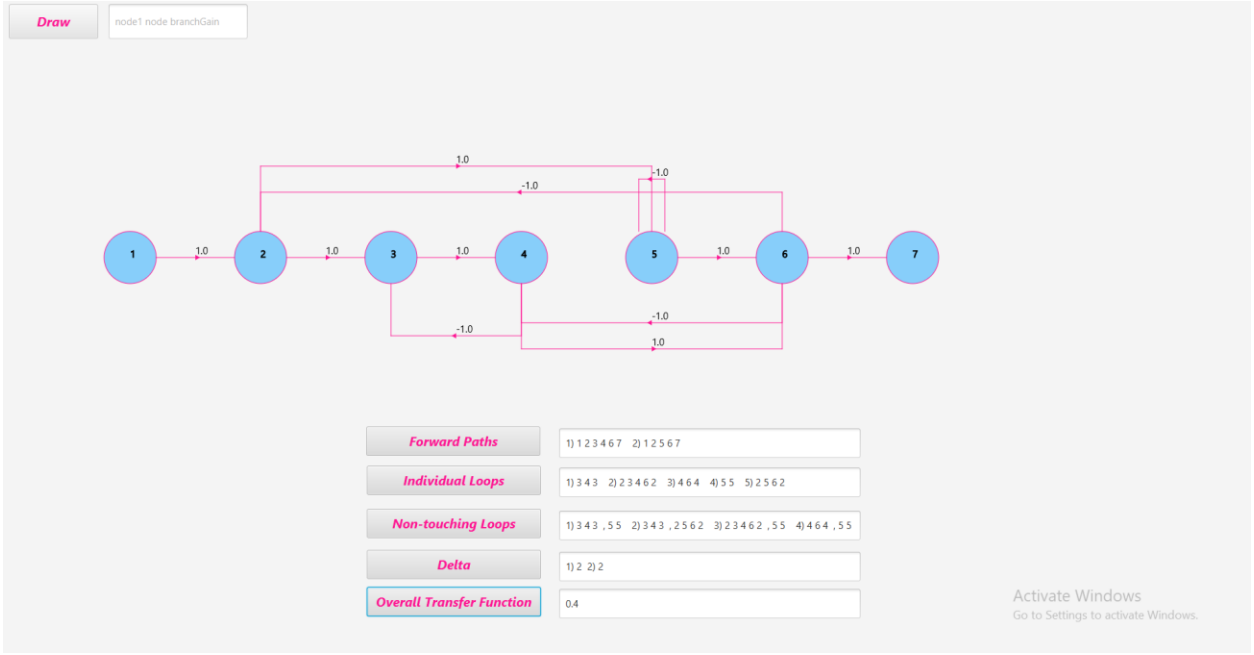
- To draw a new branch, the user should enter the name of the input node" we begin from 1 not 0", the name of the output node and the gain of the branch then press the "DRAW" button.
- To calculate the list of all forward paths, the user should press the "FORWARD PATHS" button.
- To calculate the list of all individual loops, the user should press the "LOOPS" button.
- To calculate the list of all non-touching loops, the user should press the "NON_TOUCHING LOOPS" button.
- To calculate the delta of each forward path , the user should press "Delta" button.
- To calculate the overall transfer function, the user should press the "OVERALL TRANSFER FUNCTION" button.
- The user can add new branches at any time.
- Once a branch is drawn, it cannot be removed.

- The user must calculate the answers by the order they are arranged in.

Sample runs:

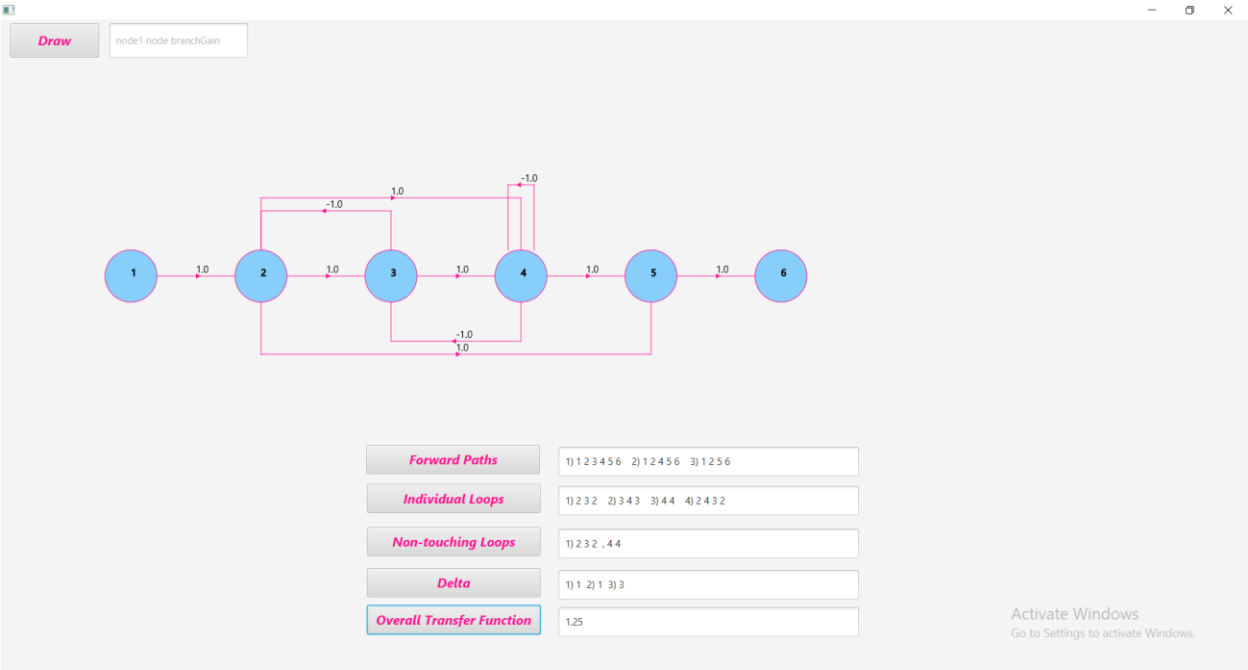
Example 1:



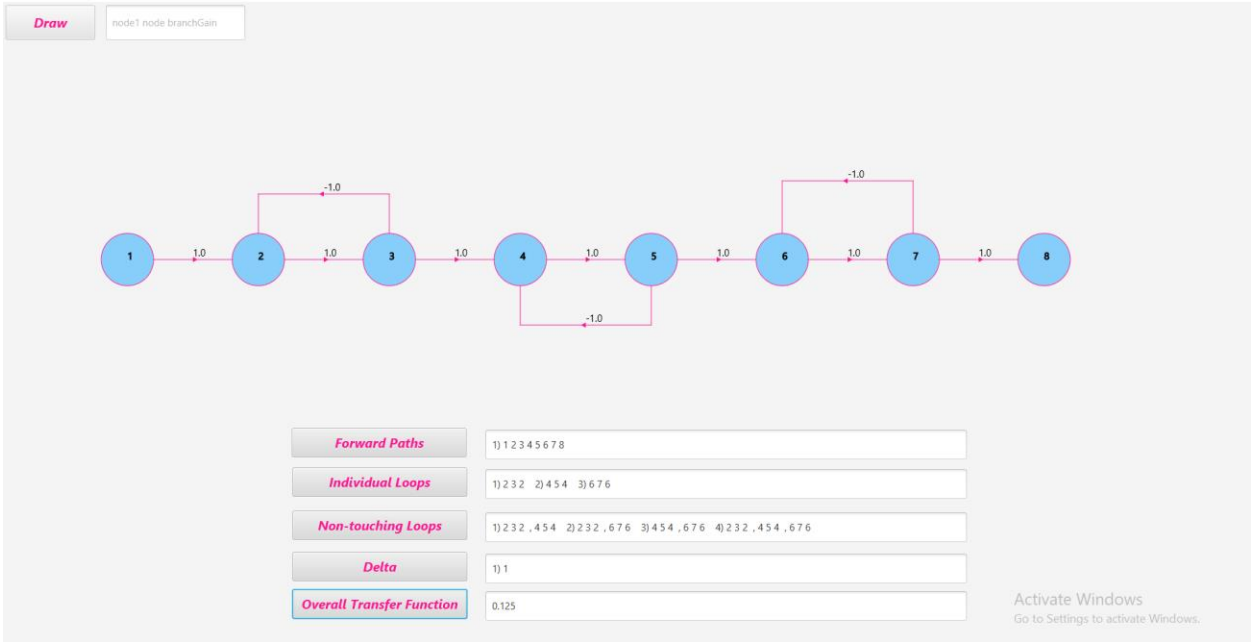


Example 2:

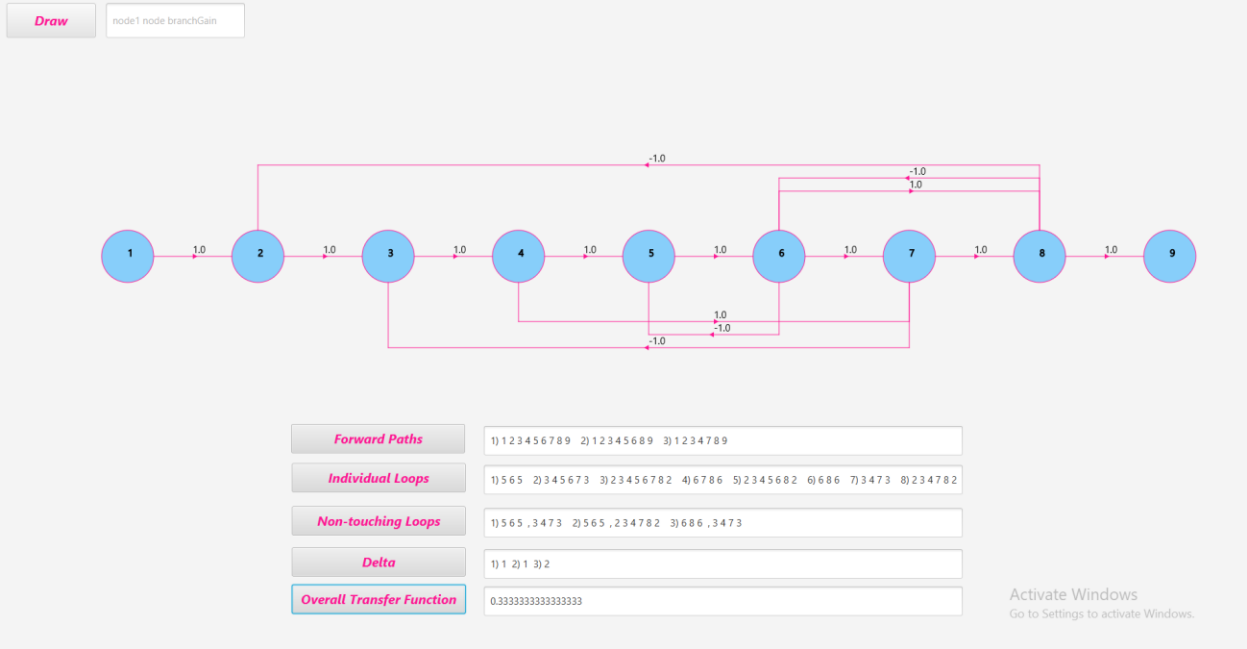
Example 3:



Example 4:



Example 5:



Example 6: