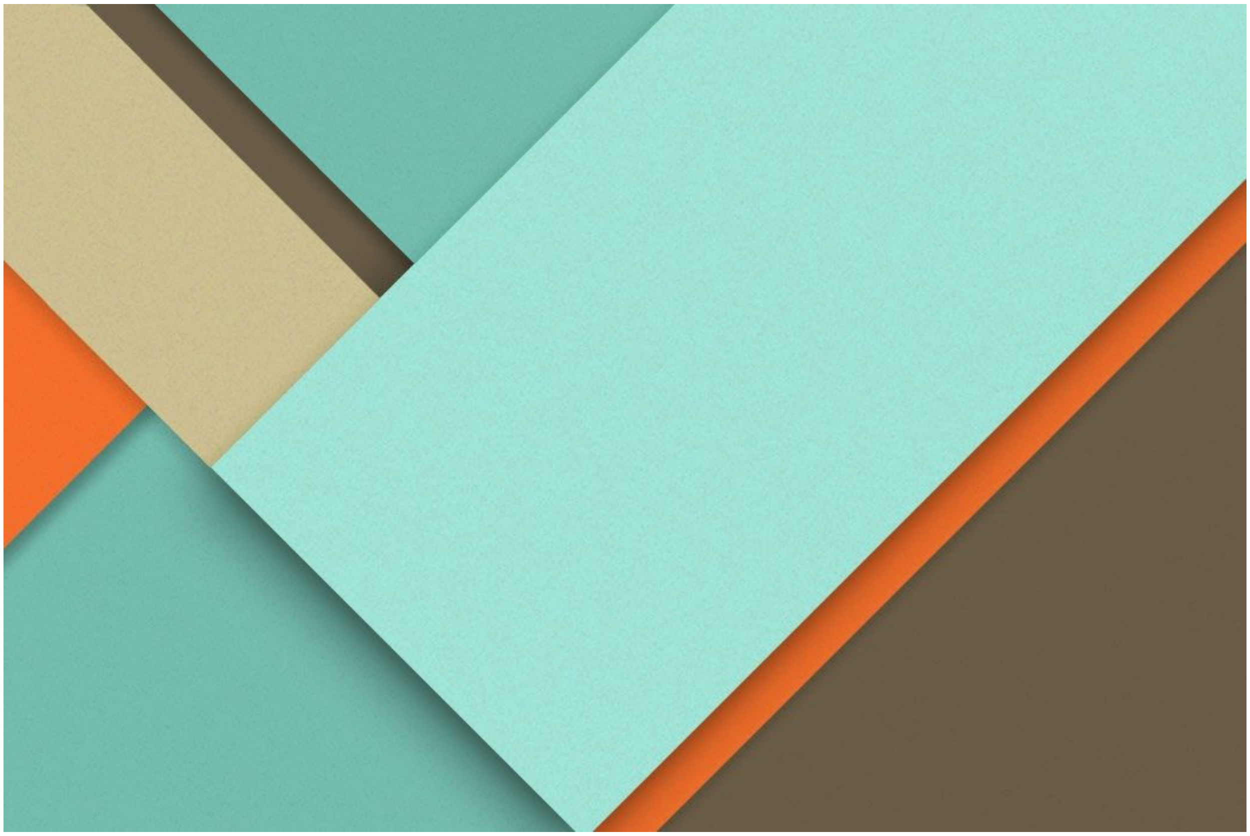


Signal Flow Graph Solver Report

Linear Control

Elsayed Akram Elsayed 16

Overview

Signal Flow Graph Solver is a GUI application that uses mason formula to solve a signal flow graph.

Mason formula states that the transfer function of a system is equal to: $\sum_{i=1}^{n}(P_i \times \Delta_i) / \Delta$

Where n = the number of forward paths

P_i = the i^{th} forward path gain

Δ = Determinant of the system

Δ_i = Determinant of the i^{th} forward path

General Design

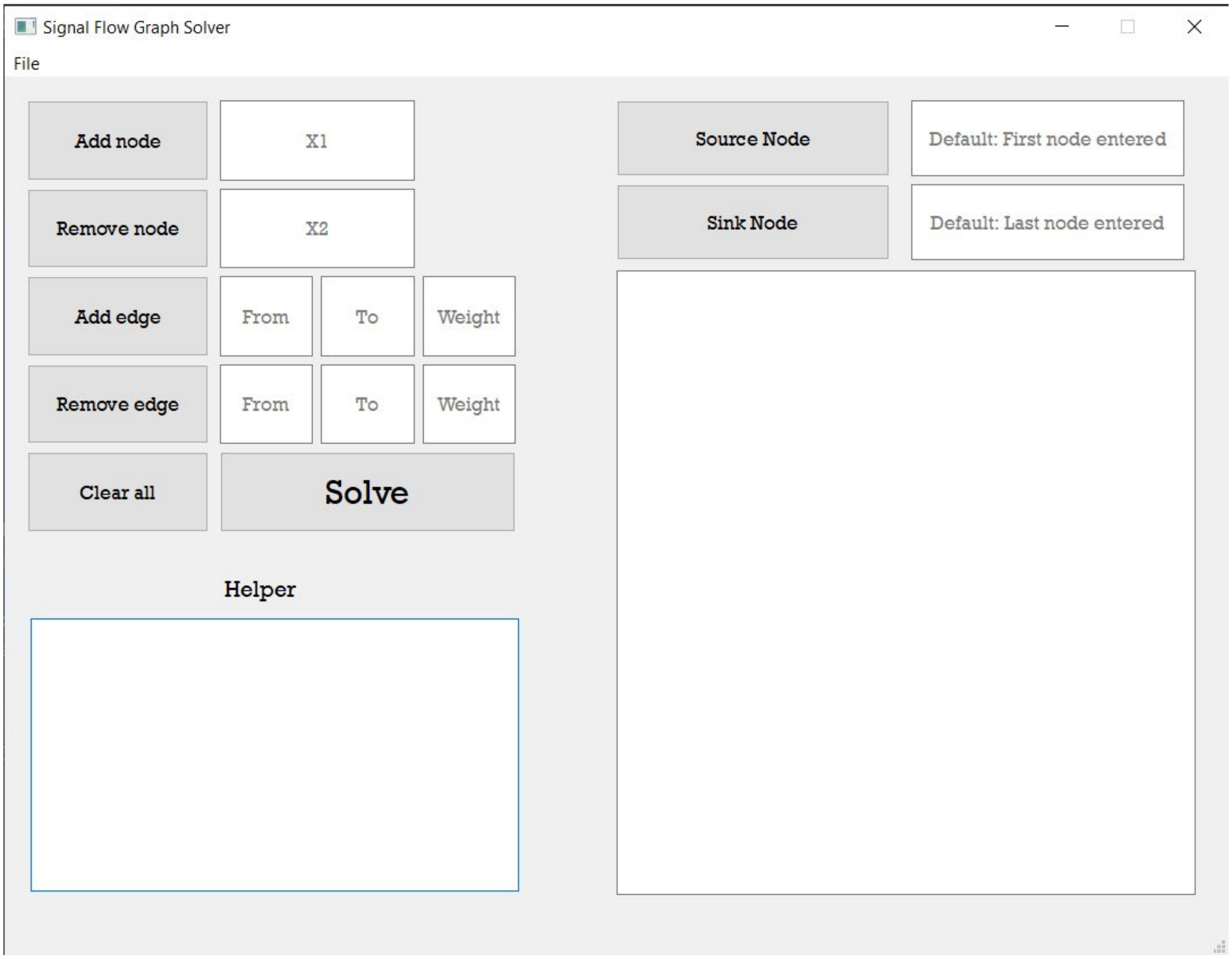
1. The project consists of three files:
    a. mason.py
    b. controller.py
    c. GUI.py
2. Mason file main method takes arguments:
    a. The graph
    b. The source node
    c. The sink node

    and outputs each of:

    d. The forward paths and its gains and determinants
    e. The determinant of the system
    f. The overall transfer function
3. Controller file is the responsible for linking between mason and GUI files and also some graph utilities
4. GUI is the main window to the user which interacts with.

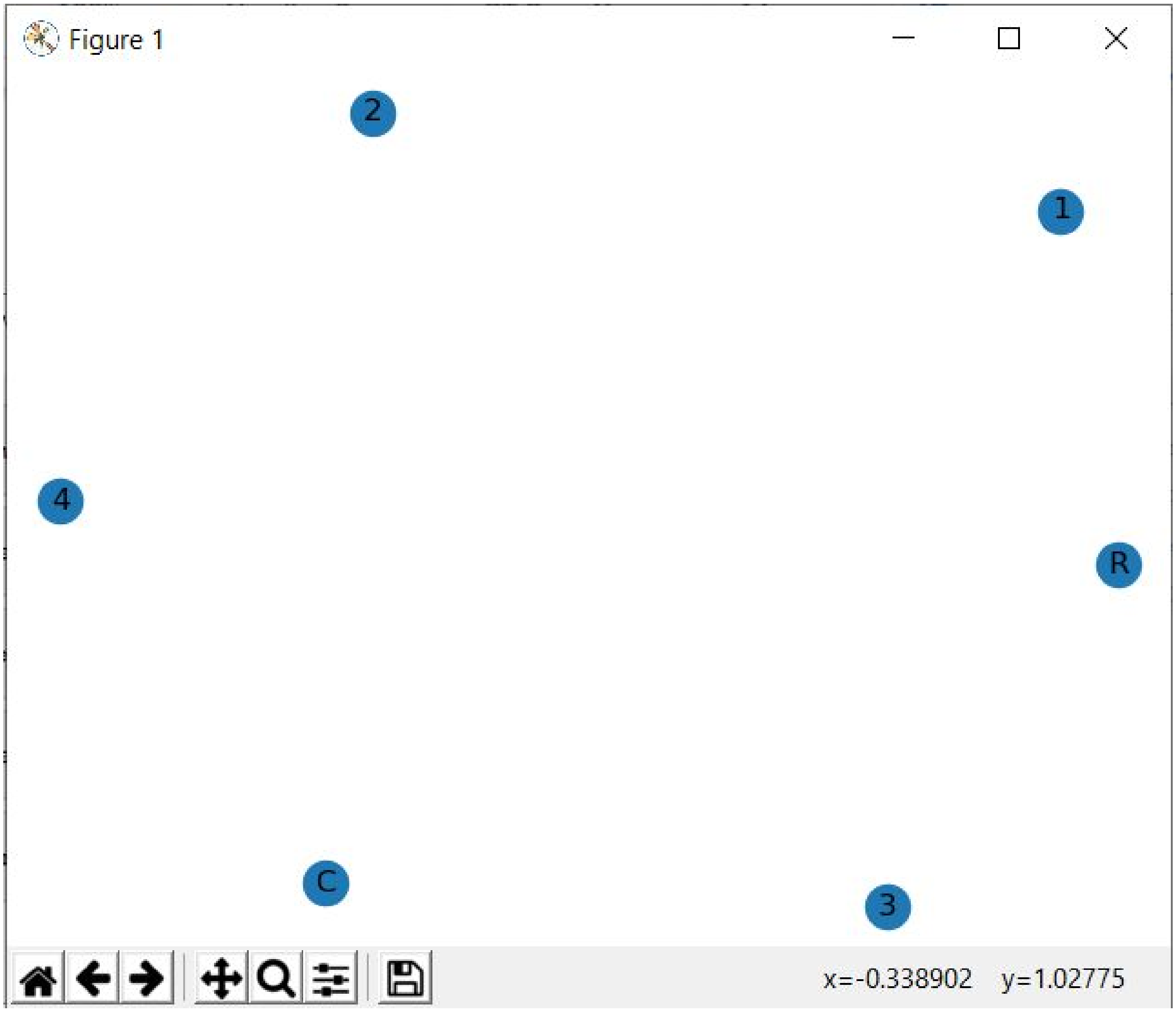
Sample Runs & Examples

Initial Interface

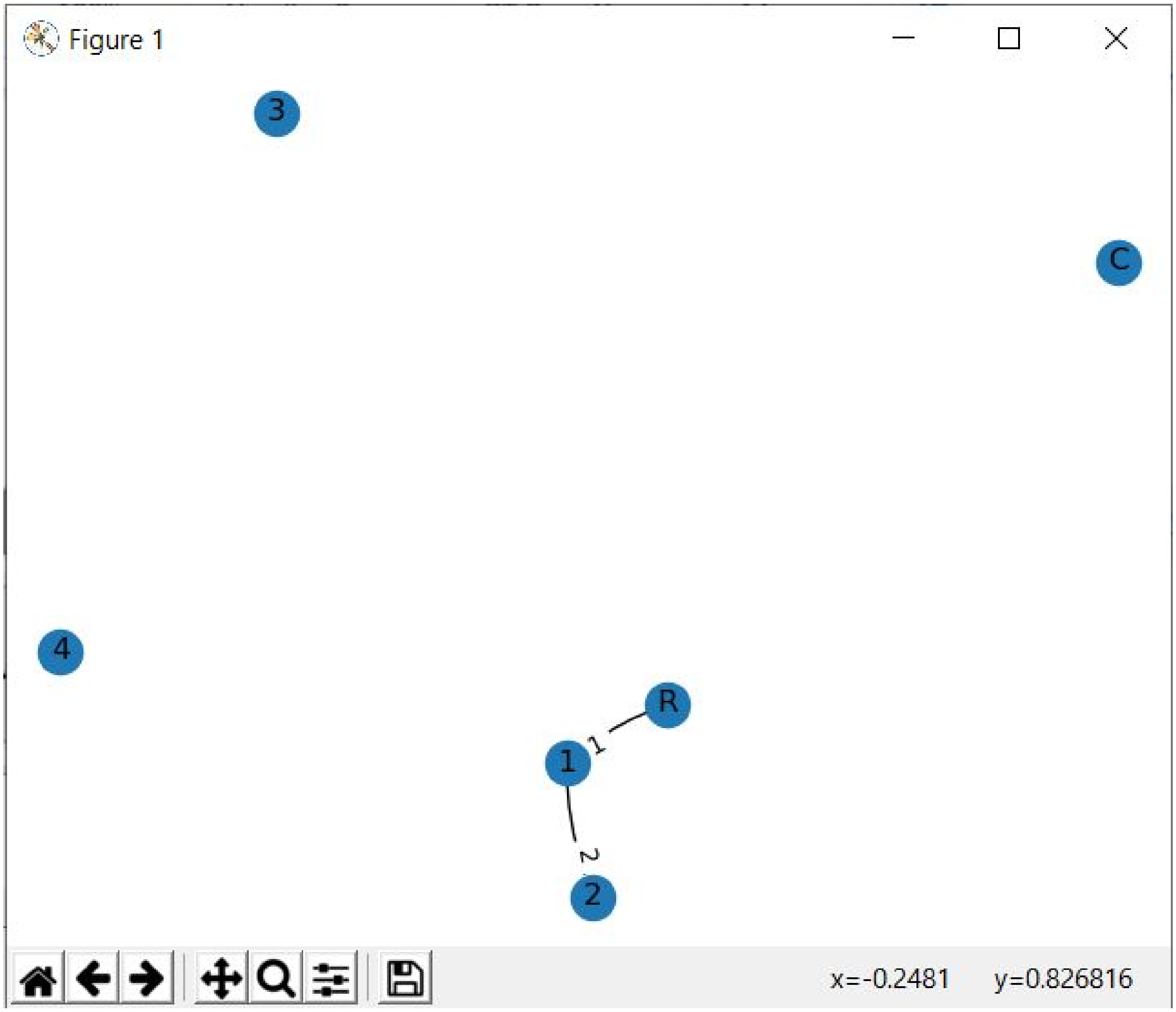


After adding the first node, a plot appears

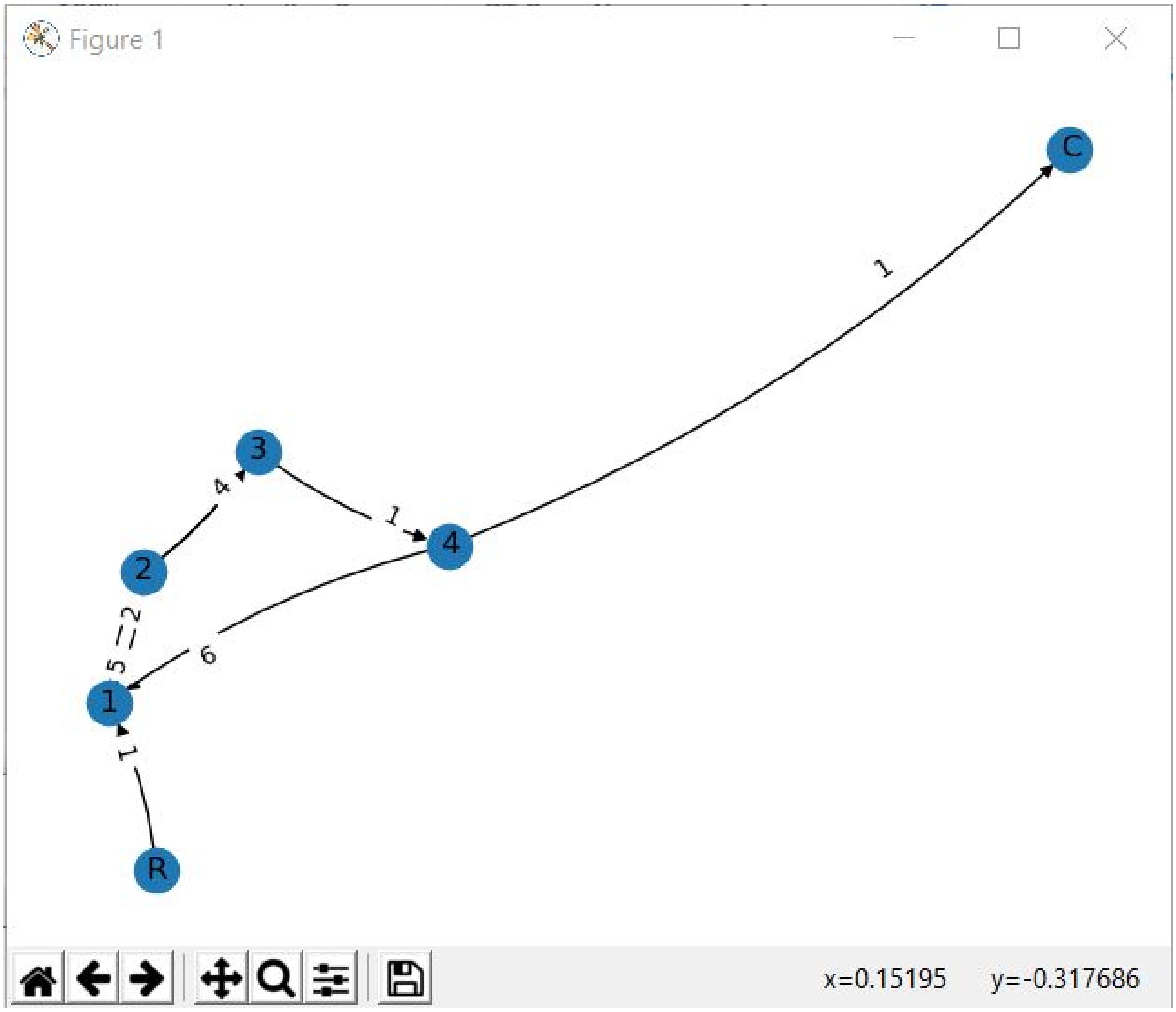
After adding 6 nodes



After adding 2 edges with weights

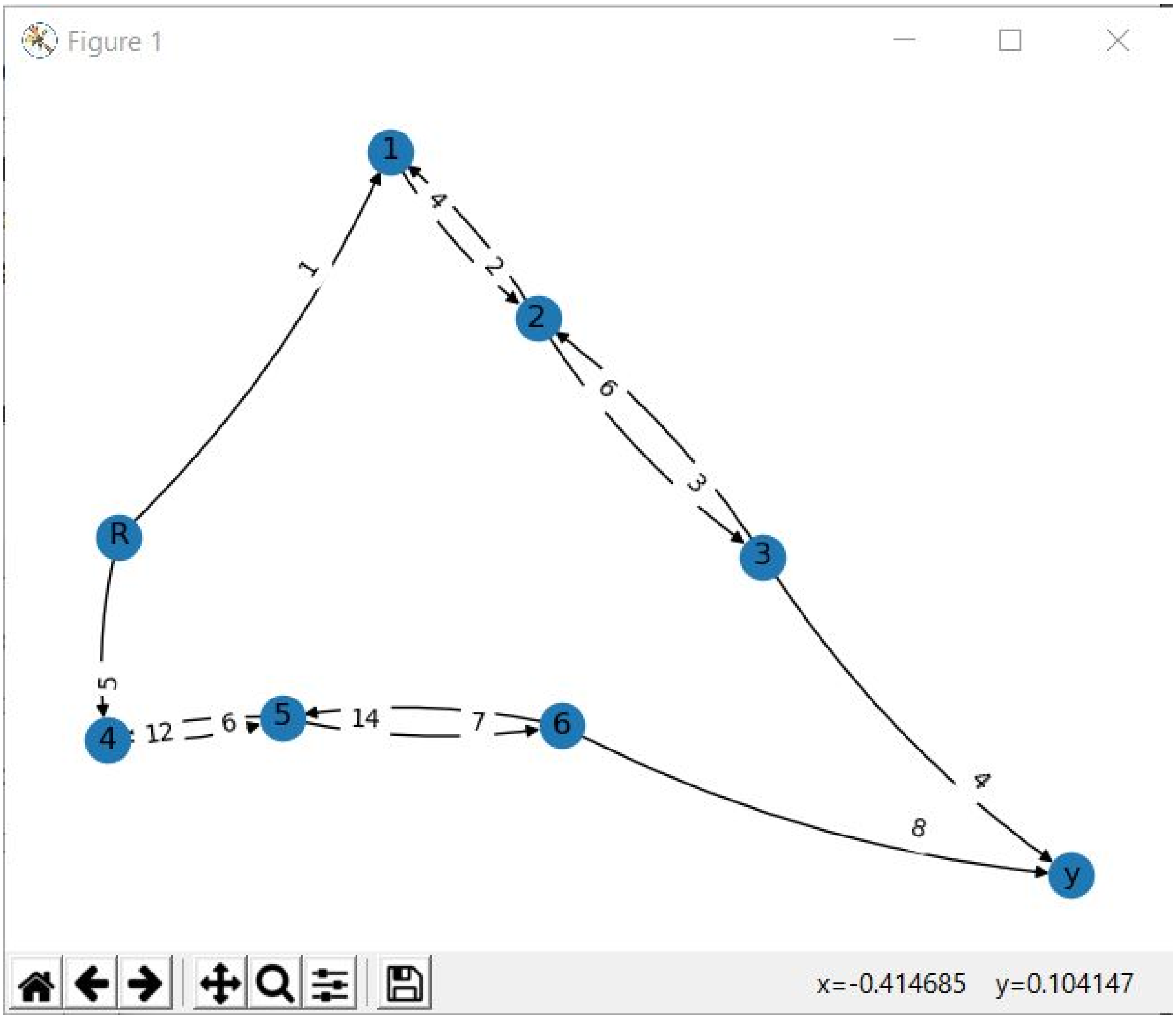


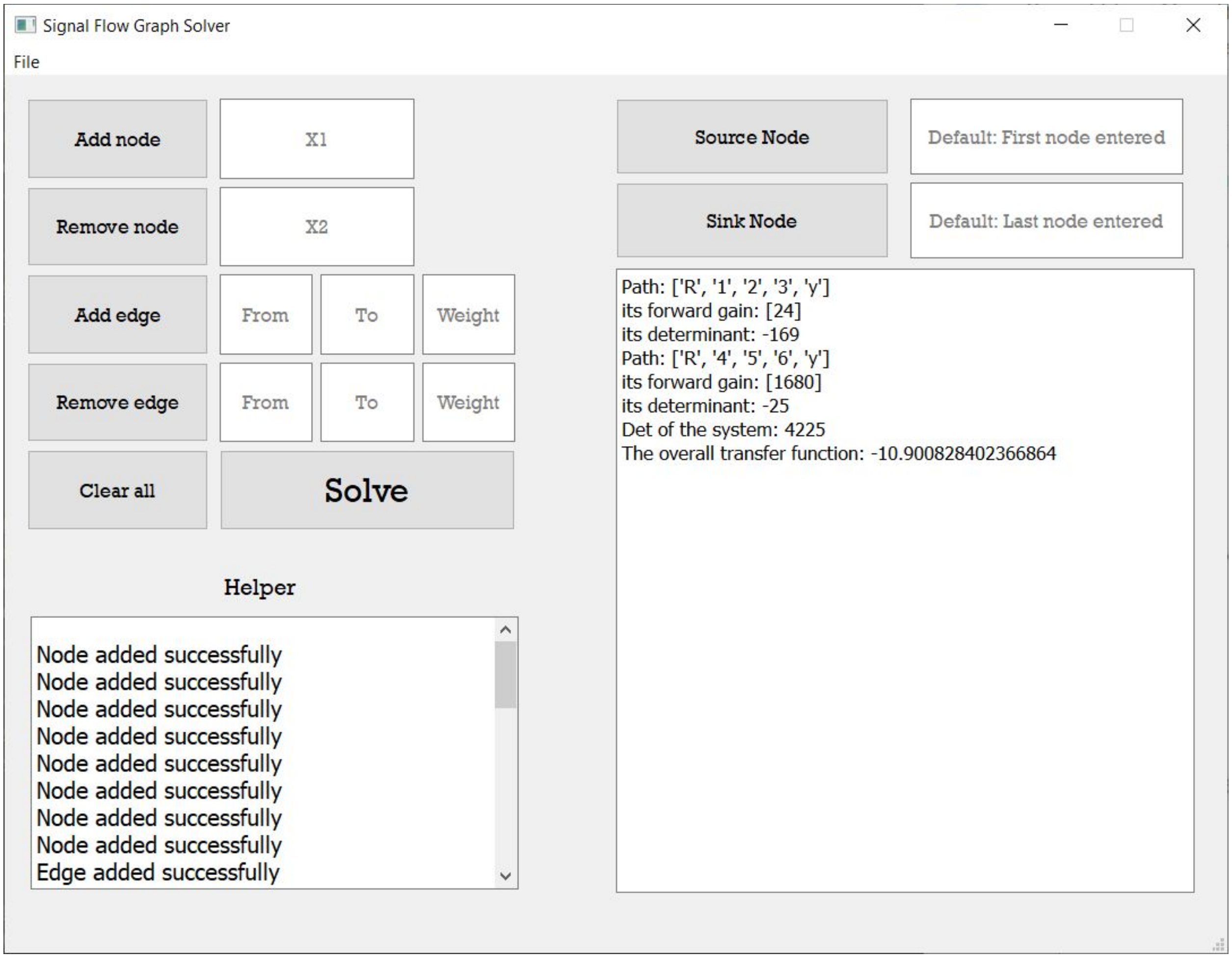
Complete graph



x=0.15195   y=-0.317686

Another complete graph and its overall transfer function

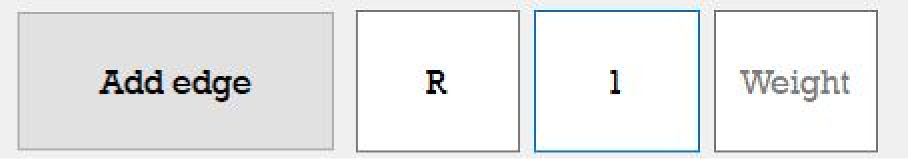




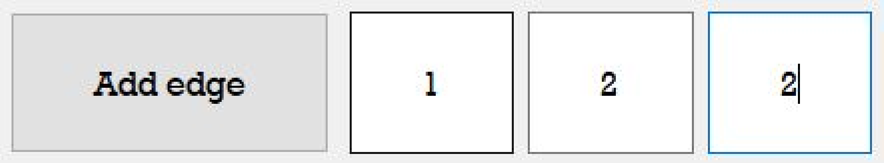
```
Path: ['R', '1', '2', '3', 'y']
its forward gain: [24]
its determinant: -169
Path: ['R', '4', '5', '6', 'y']
its forward gain: [1680]
its determinant: -25
Det of the system: 4225
The overall transfer function: -10.900828402366864
```

```
Node added successfully
Node added successfully
Node added successfully
Node added successfully
Node added successfully
Node added successfully
Node added successfully
Node added successfully
Edge added successfully
```

Two options for adding an edge where the default weight is one



R | 1



1 | 2 | 2

Incomplete functions

1. Remove edge button is not working correctly.
2. Duplicate edges between nodes are added without checking.

Imported Libraries

1. networkx: provided the graph data structure for easier manipulation and analysis of complex graphs
2. itertools: used in small combinatorial part in get_gains method in mason.py