Working of the Simulator

When the user run the simulator, a message box opens up. The user may close the message box by selecting the **ok** button. Initially, the canvas is empty with a few buttons at the bottom. In order to study the effect of shocking a network, at least the following tasks need to be performed.

- The canvas has to be loaded with the network.
- Nodes in the network need to be shocked.

At any point of time:

- The user may clear the contents in the canvas by using the **Clear Canvas** button.
- The user may exit the simulator by selecting **Quit** button.

By default, the results of the simulator are stored in the current directory, *i.e.*, the folder where the simulator is saved. The user can hoose select different location to save the result by using the **Directory of Graph Storage** button, at which point the selected location becomes the new default location. The user will always be asked for the location to store the result once the result is ready.

1 Loading a network

A network can be loaded to the canvas either

1.1 by generating the network, or

1.2 by retrieving an available network.

1.1 Generating a network

There are six different types of networks that can be generated by using the following buttons:

- Homogeneous Scale free network **SF Graph Generation**
- Homogeneous Erdös-Rényi random network **ER Graph Generation**
- Homogeneous inarborescence Tree **Homogeneous Inarborescence Tree Generation**
- Heterogeneous Scale free network **Heterogeneous SF Graph Generation**
- Heterogeneous Erdos-Renyi random network **Heterogeneous ER Graph Generation**
- Heterogeneous inarborescence tree **Heterogeneous Inarborescence Tree Generation**

The simulator requests the user for the following additional appropriate inputs and then generates the network.

Number of nodes of the network

This is the first step while generating any network. The default value is 100 (*i.e.*, if the user does not enter the number of nodes then the simulator assumes the it to be 100). The user may decide to cancel the network generation by selecting the **cancel** button on the *input window*.

Average degree (for ER and SF networks only)

Next, the simulator requests the user about the average degree for ER and SF networks.

- The user may select **Yes** to generate a network with particular degree.

  If the user selects this option, then the a new input window appears to request the value from the user. The user may enter any value greater than 0 and less than or equal to 6. The default value is set as 3 (*i.e.*, if the user does not enter a value then the simulator assumes it to be 3).

- To generate a network of *random* degree the user may select **No**.

Distribution of external and internal assets (for heterogeneous networks only)

For heterogeneous networks, the user is requested to input the distribution of internal and external assets in the network. There are two choices of thedistribution:

- distribute 95% of assets among 10% nodes and links, or
- distribute 60% of assets among 40% nodes and links.

Once the required details are entered the generated network appears on the canvas. A new window appears allowing the user to *save* the generated network. The user may proceed without saving the network. If the user decides to save the network a new window appears allowing the user to decide the location to save the network. The network is saved as the `text` file, and the user is asked for the name of this file.

1.2 Retrieving a network

The simulator allows the user to retrieve an available network (previously generated and saved, or manually generated by the user) from any location on the computer by selecting the **Retrieve Graph** button. The network is loaded on the canvas and is ready to be shocked.

2 Shocking the network

There are two types of shock that can be applied to the graph

Idiosyncratic shock (shock randomly selected nodes)

Coordinated shock (a type of correlated shock)

Once the user selects the type of shock, the simulator requests for following inputs from the user:

Severity of the shock: a real number between 0 and 1, with a default value is 1/2.

The Equity to asset ratio: any positive real number that is less than the severity of the shock.

The External Assets to Internal Assets Ratio

The percentage of nodes to be shocked

Once the network is loaded and a shock is applied, the nodes initially shocked are colored in **pink**. The user is now given three options:

- Continue step-by-step simulation (by selecting **OK**).
- Stop simulation.
- Stop step-by-step simulation — skips the step-by-step propagation of shock and gives the final output.

When the nodes receiving the shock manage to survive the simulation is complete and the output window appears. If a node receiving the shock do not survive then it will propagete a part of the shock to its neighbors. The neighbors that receive the propagated shock are colored **green**. When a node receives a shock from its neighbor a window appears allowing the user to decide among the following three options:

- Continue step-by-step simulation (by selecting **OK**).
- Stop simulation.
- Stop step-by-step simulation — skips the step-by-step propagation of shock and gives the final output.

If the user chooses to continue then the shock propagation continues. There is a window that appears during this shock propagation process informing the user that the simulator is active and also gives the user a opportunity to stop/cancel the simulation process. Each time a node fails a new window appears with the information about the failed node. The window also gives the user the following three options: decide among the following three options:

- Continue step-by-step simulation (by selecting **OK**).
- Stop simulation.
- Stop step-by-step simulation — skips the step-by-step propagation of shock and gives the final output.

Once the shock propagation process is complete the output window appears. The user must close the output window. The user is now given a choice to either save the output or proceed without saving.