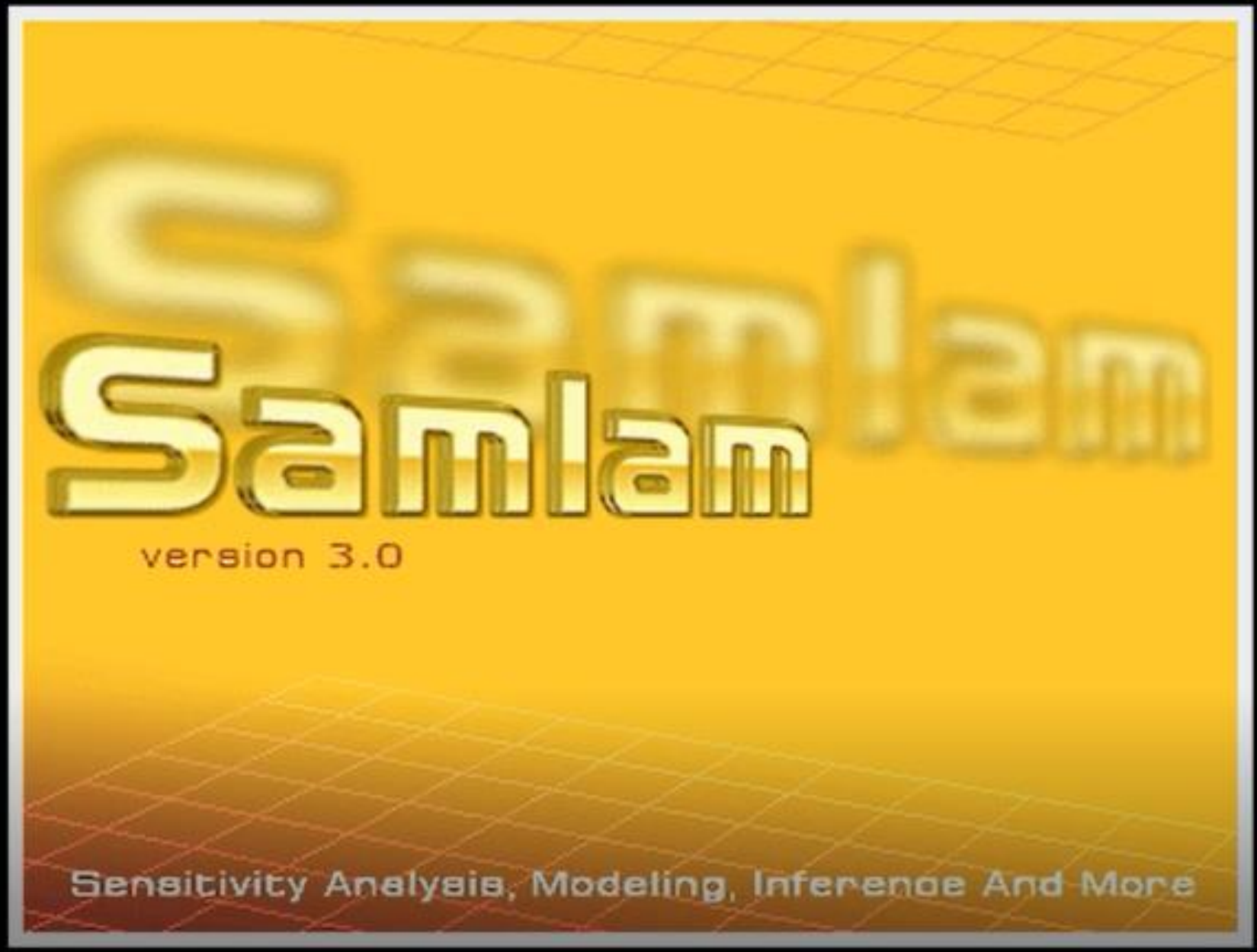

Samlam
version 3.0
Sensitivity Analysis, Modeling, Inference And More

Samlam Introduction

- **Samlam is a comprehensive tool for modeling and reasoning with Bayesian networks**, developed in Java by the Automated Reasoning Group of Professor Adnan Darwiche at UCLA.
- Samlam stands for Sensitivity Analysis, Modeling, Inference And More.
- Samiam **includes two main components**:

  - **a graphical user interface** that lets users develop Bayesian network models and save them in a variety of formats.

  - **a reasoning engine** that supports many tasks including: classical inference; parameter estimation; sensitivity analysis; and explanation-generation based on MAP and MPE.

Bayesian network

- A **Bayesian network** is an acyclic oriented graph in which nodes are random variables. For each node it is associated a conditional probability function which, note the values of the "parent" node variables assign a probability to the variable for the "child" node.

- **Causal graphs** are a special type of Bayesian network in which the edges between the variables have a causal meaning.

Bayesian network

- For both is valid the chain rule

Product decomposition (the chain rule)

– For a directed acyclic graph with probabilistic information in the nodes it holds that

$$P(x_1, x_2, \ldots, x_n) = \prod_i P(x_i | pa_i)$$

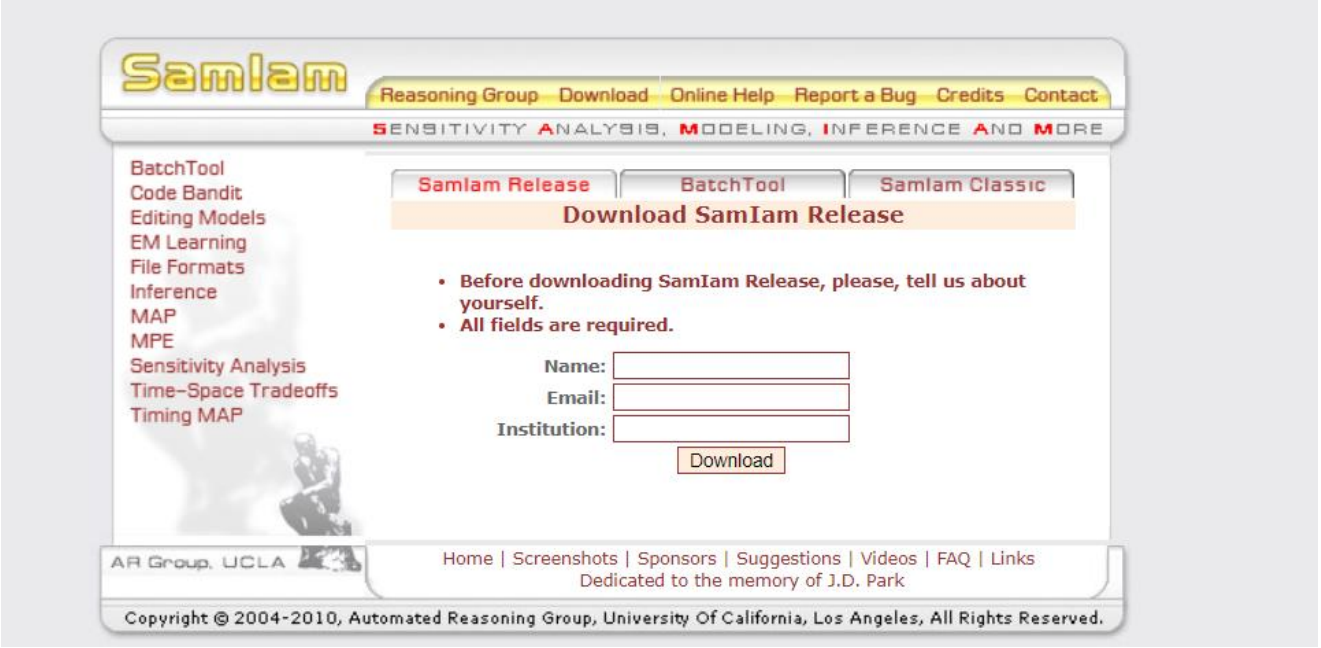
where the product runs over all the nodes

Samlam Introduction

- You can download the software here (**download samiam CLASSIC**):

  http://reasoning.cs.ucla.edu/samiam/index.php?s=

Before the download you will be asked to insert some credentials:



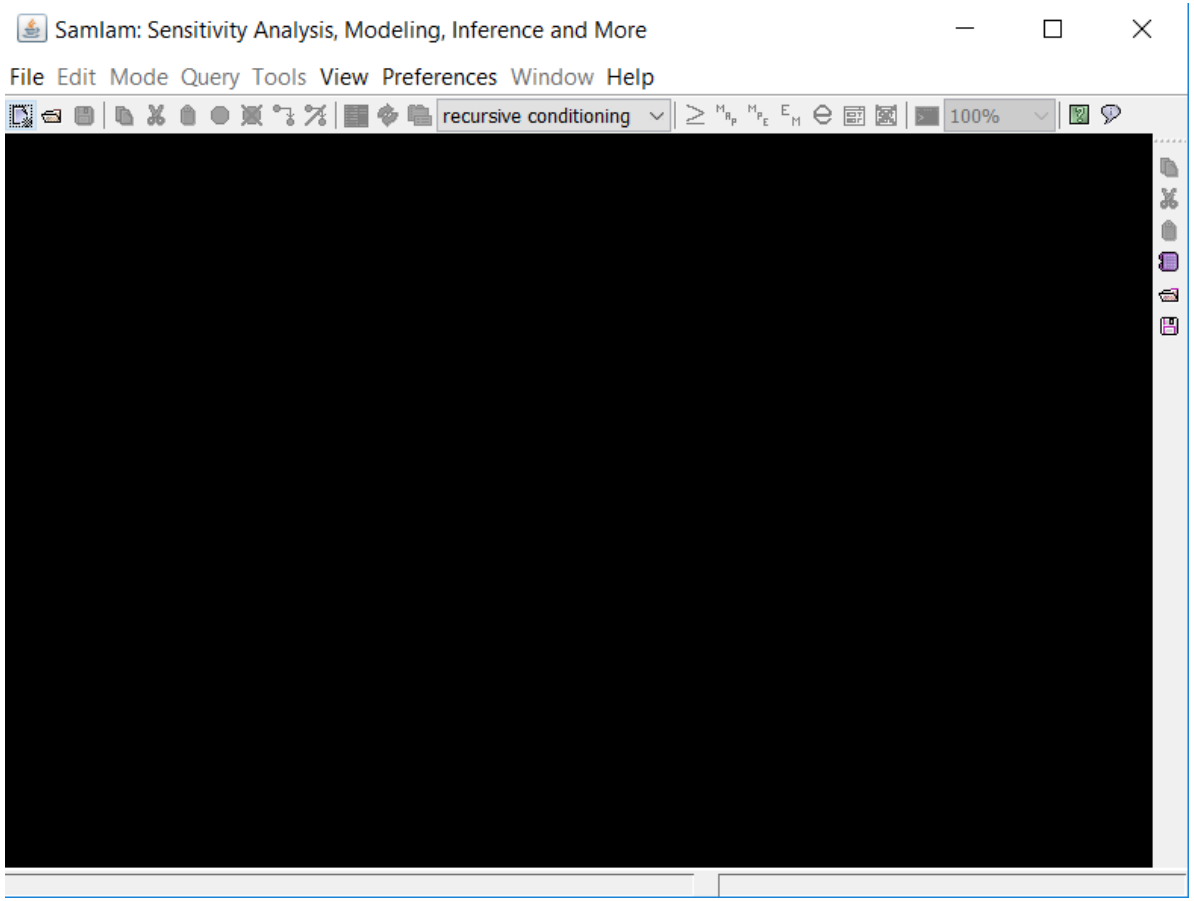
SamIam Introduction

- You can also find other documentation and video tutorials on SamIam at this link:

http://reasoning.cs.ucla.edu/samiam/help/

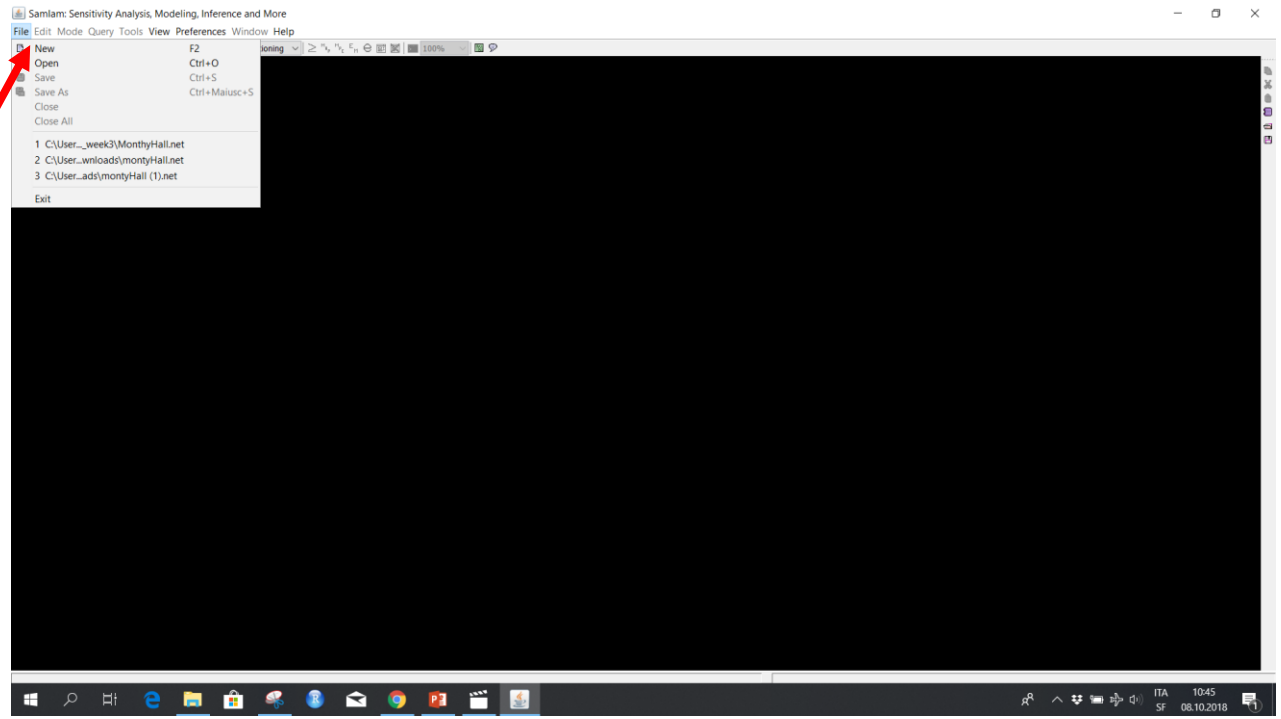
Samlam Introduction

- After the download you can open the program:



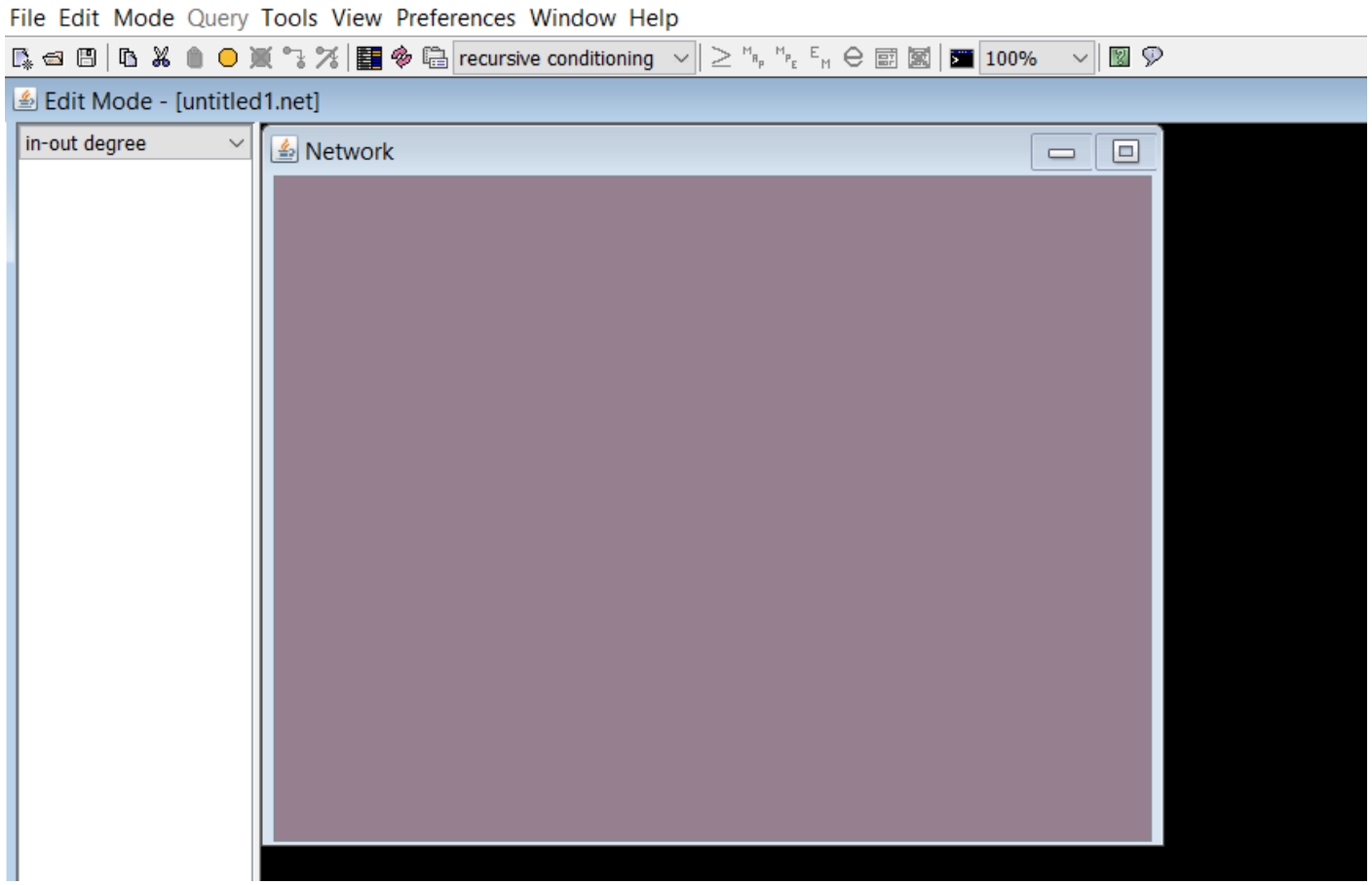
Samlam Introduction

- After the download you can open the program:



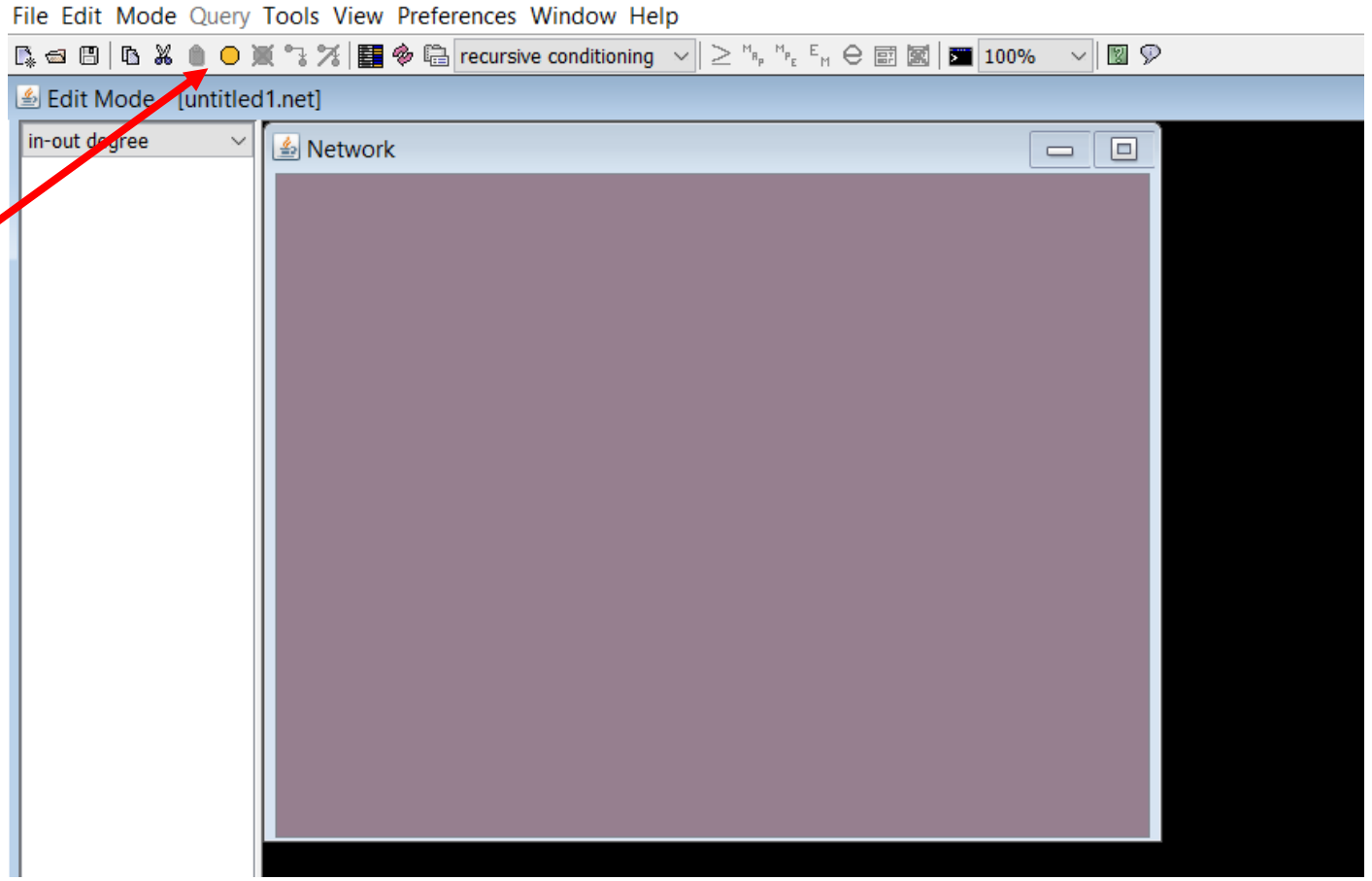
Clicking on «New» you can create a new Bayesian network through its graphical representation

Samlam Introduction



Samlam Introduction

- Now you can start to create your network!

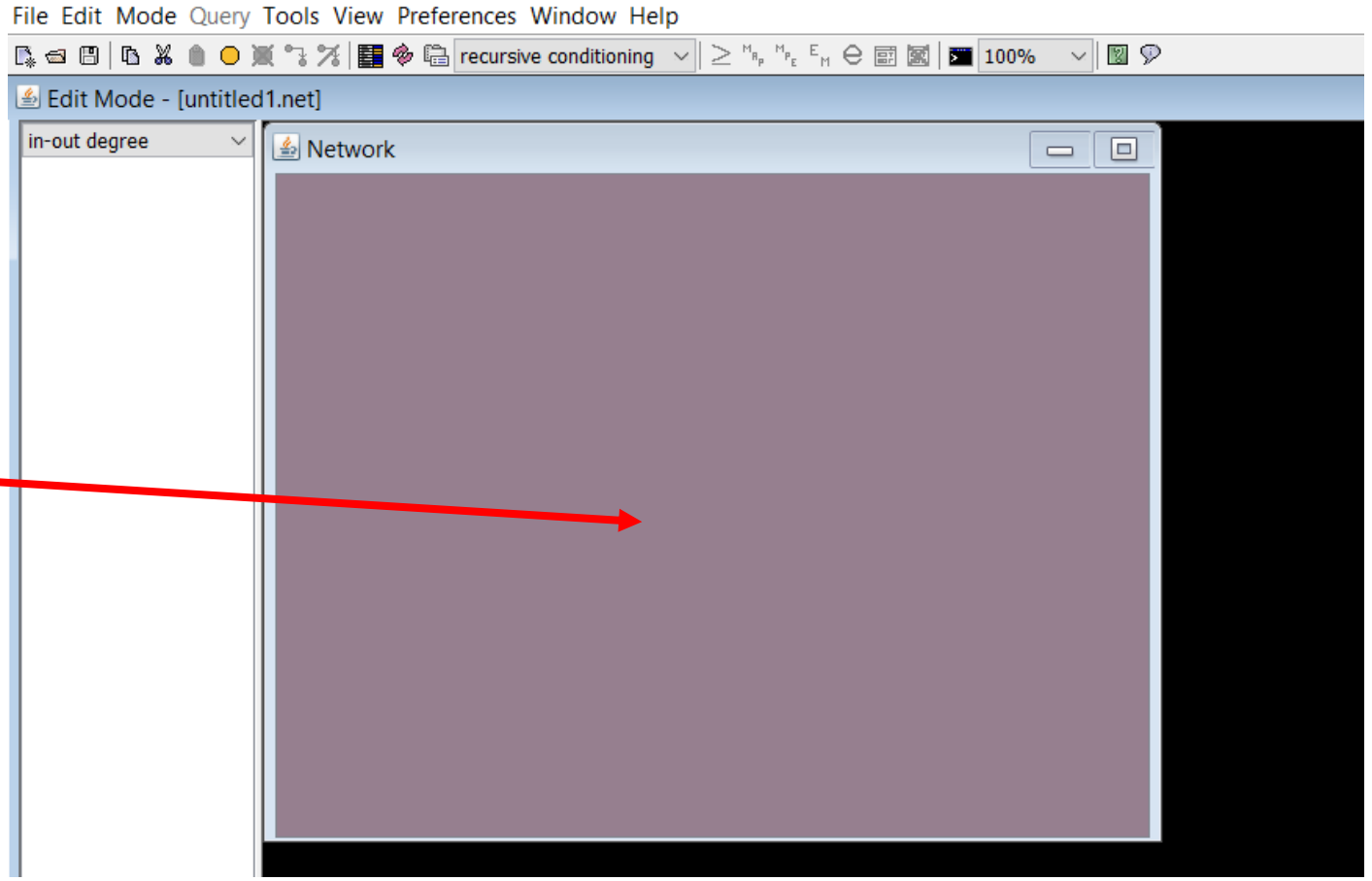


Clicking here you can insert the nodes of your network

Samlam Introduction

- Now you can start to create your network!

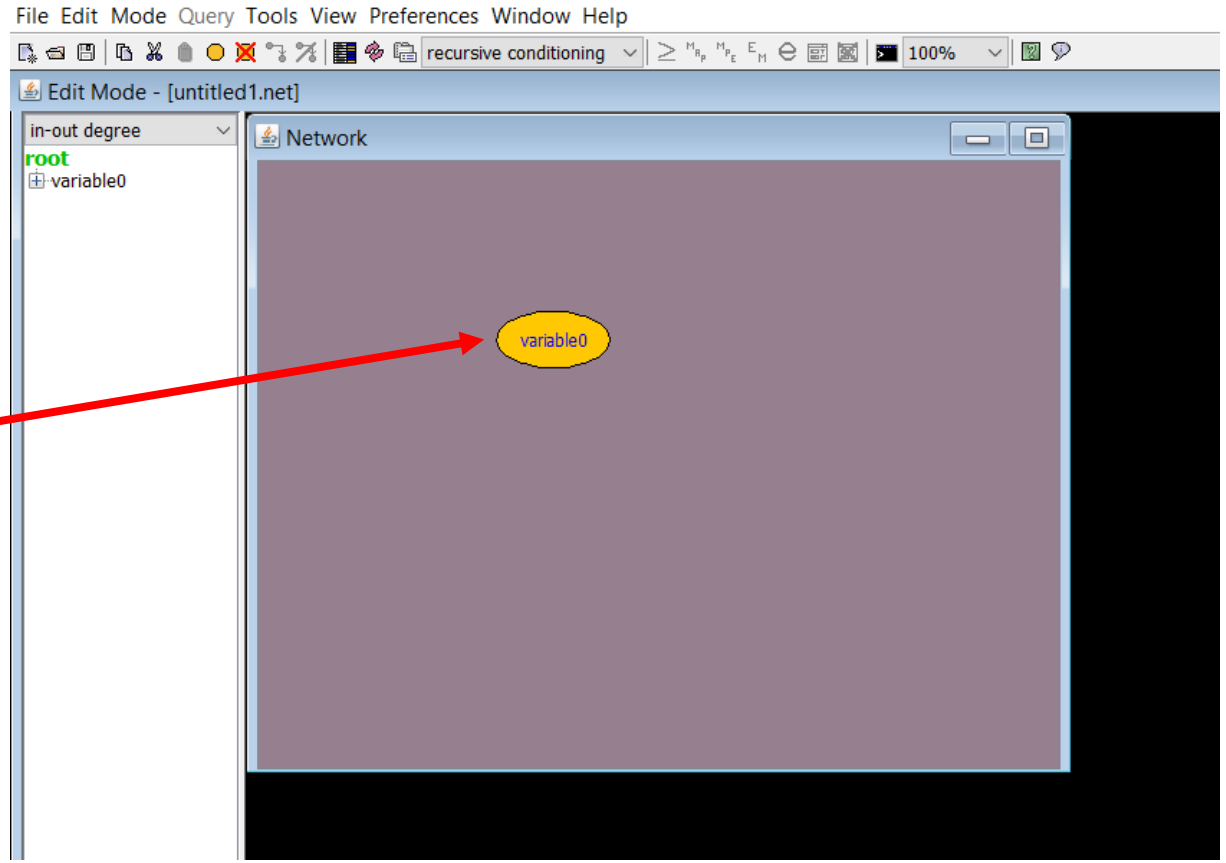
After clicking you must choose the location of the node



Samlam Introduction

- Now you can start to create your network!

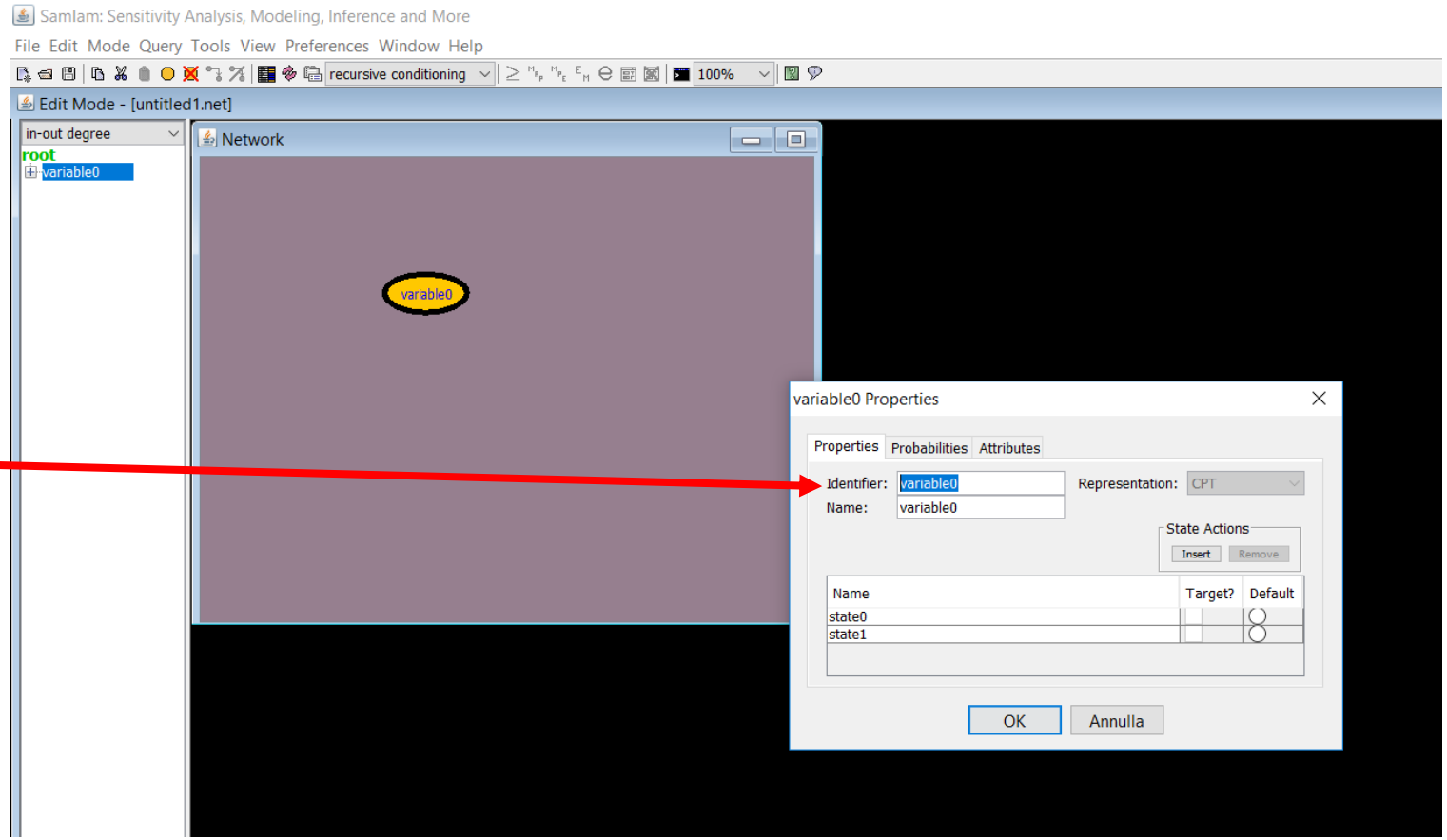
Now you can rename the node double clicking on it (avoiding spaces between letters or words)



Samlam Introduction

- Now you can start to create your network!

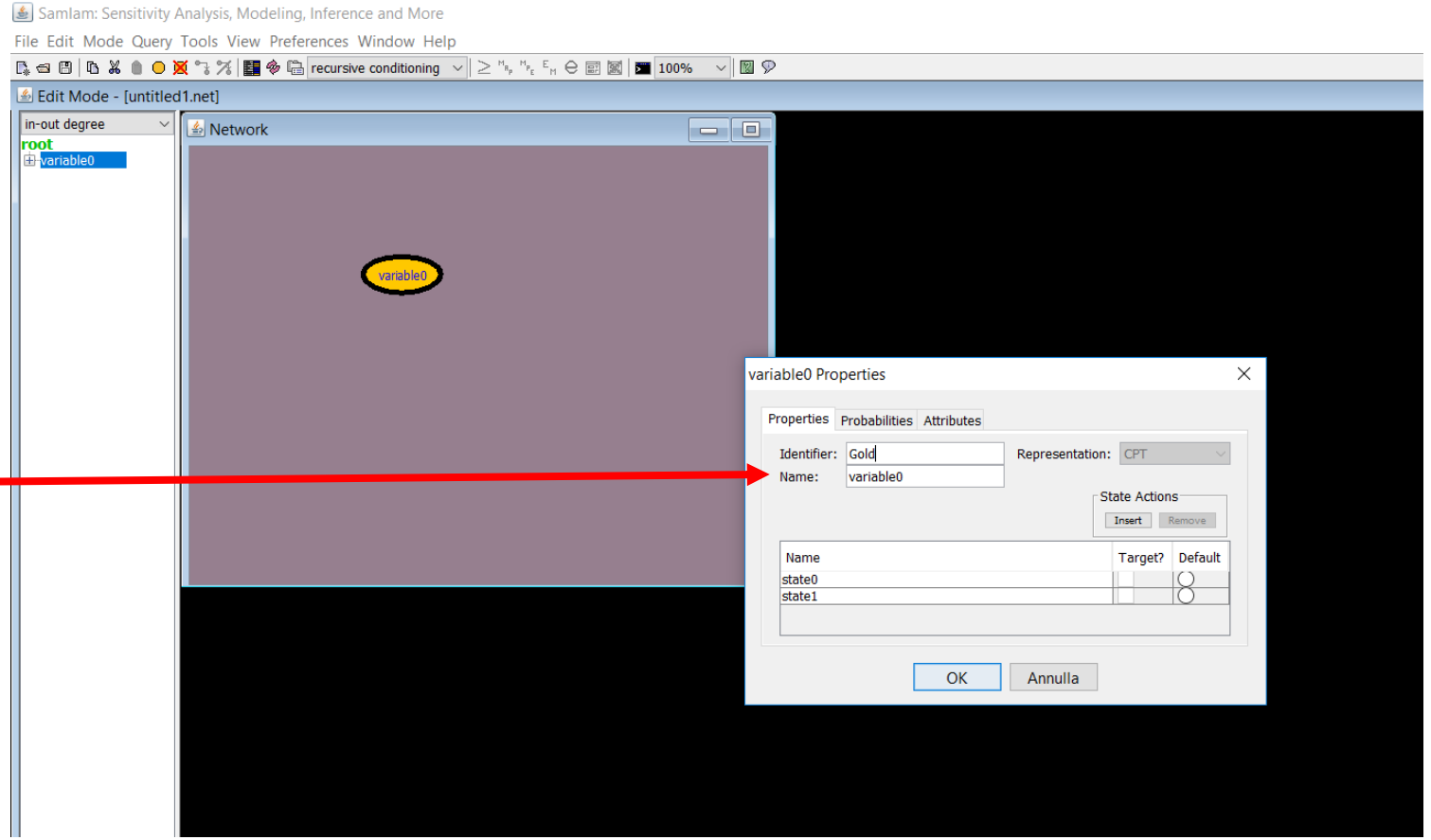
You can choose the identifier of the node (univocal for every node)



Samlam Introduction

- Now you can start to create your network!

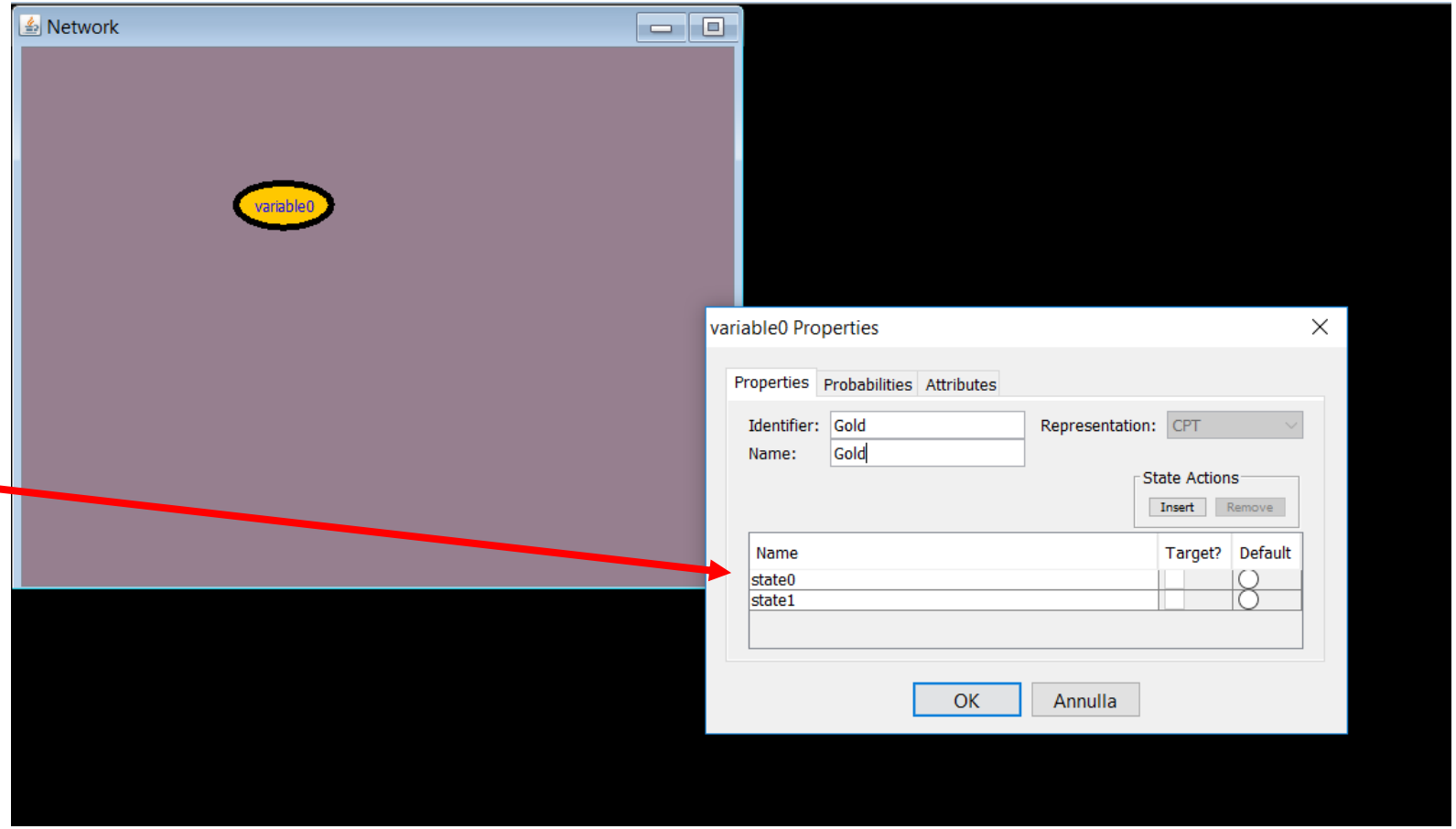
You can choose the name (it can be equal or different to the identifier)



Samlam Introduction

- Now you can start to create your network!

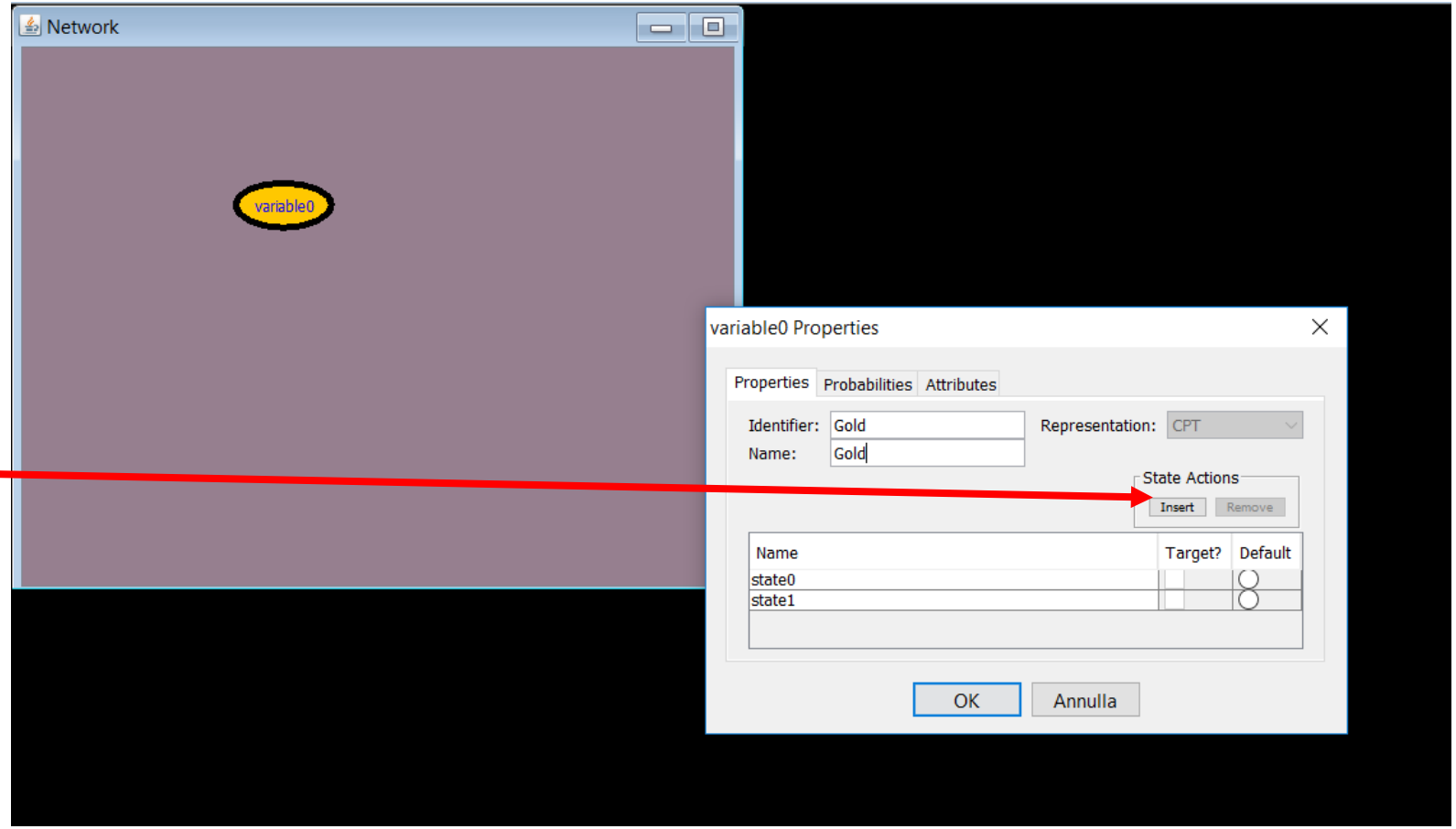
And the states of the variable that the node represents



Samlam Introduction

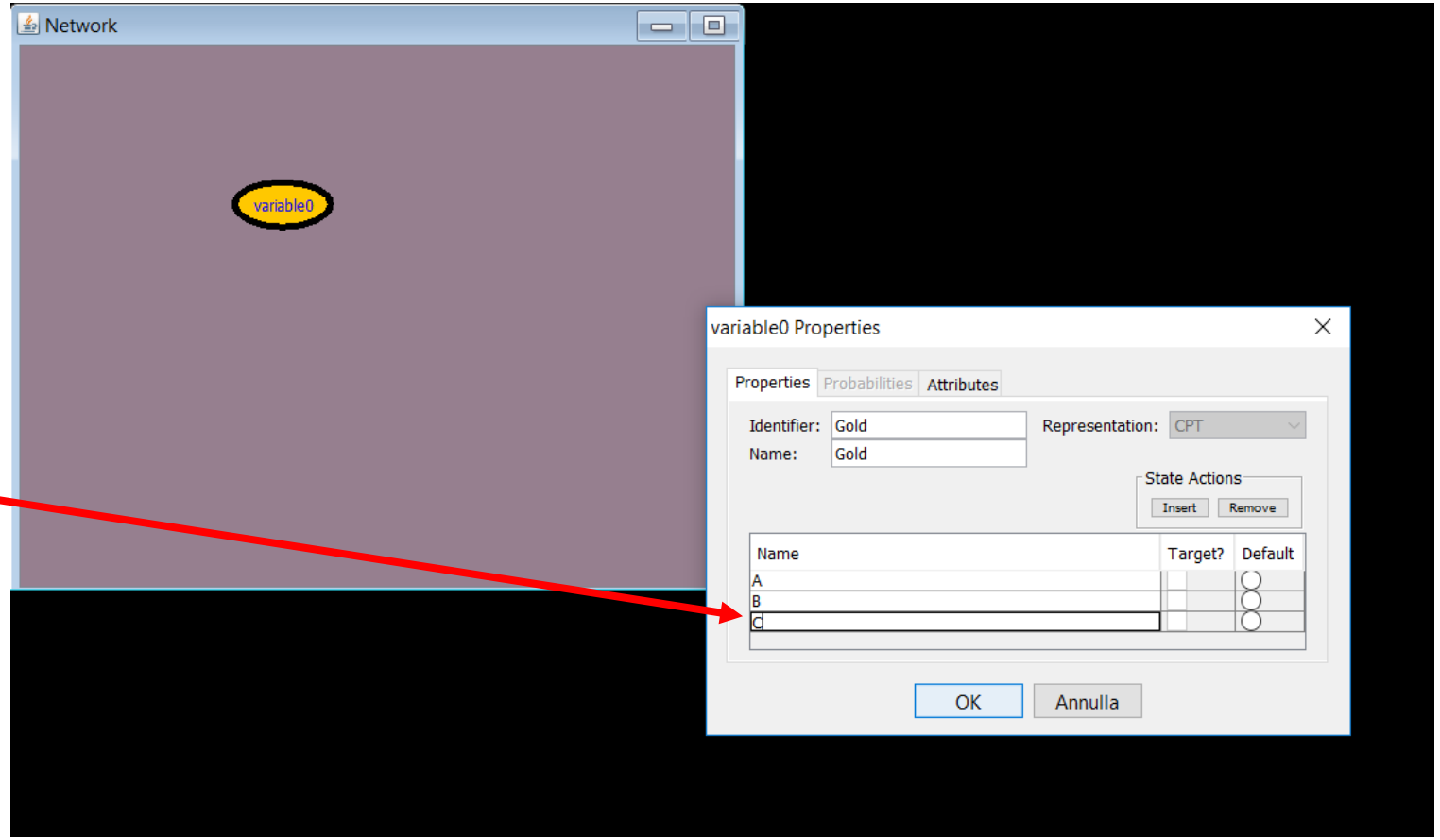
- Now you can start to create your network!

You can also add or remove some states



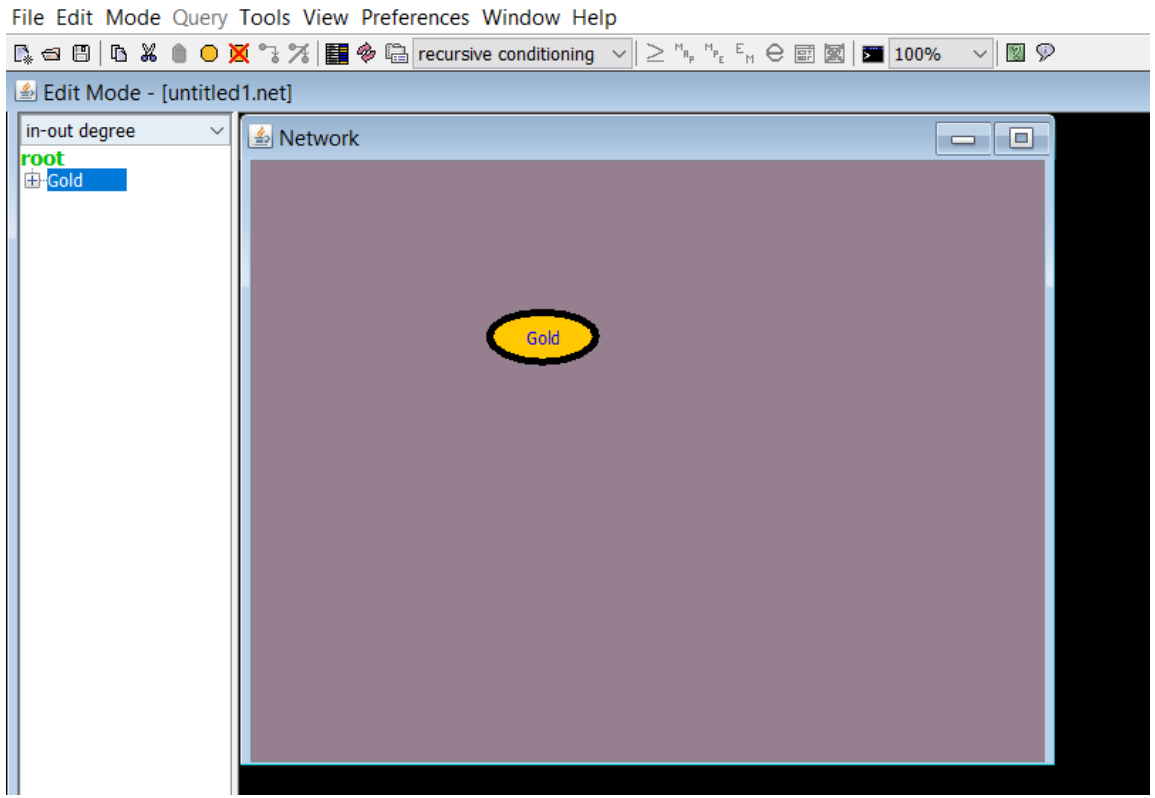
Samlam Introduction

- Now you can start to create your network!



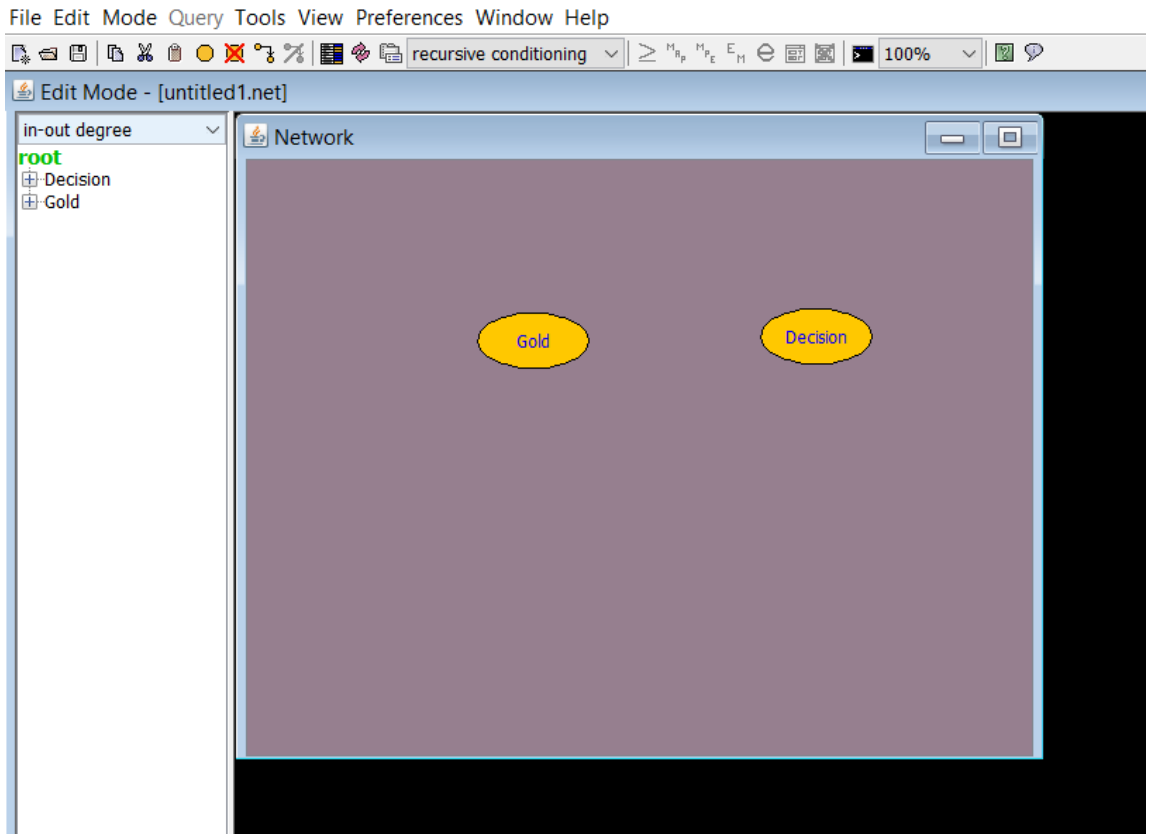
Samlam Introduction

- Clicking on «OK» you have your node



Samlam Introduction

- In this way you can create some other node:

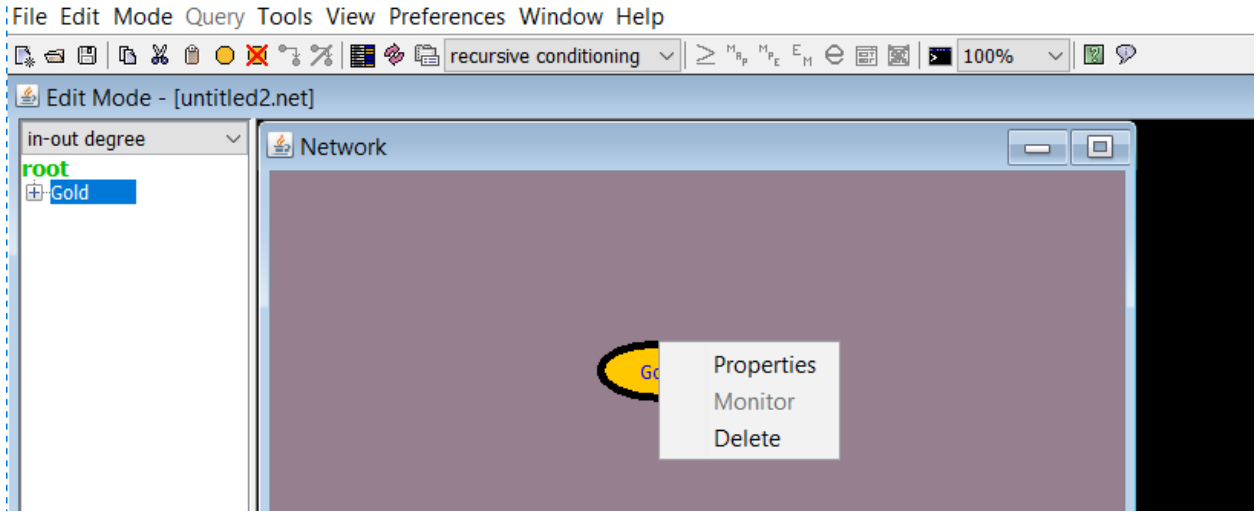


Samlam Introduction

- You can always:

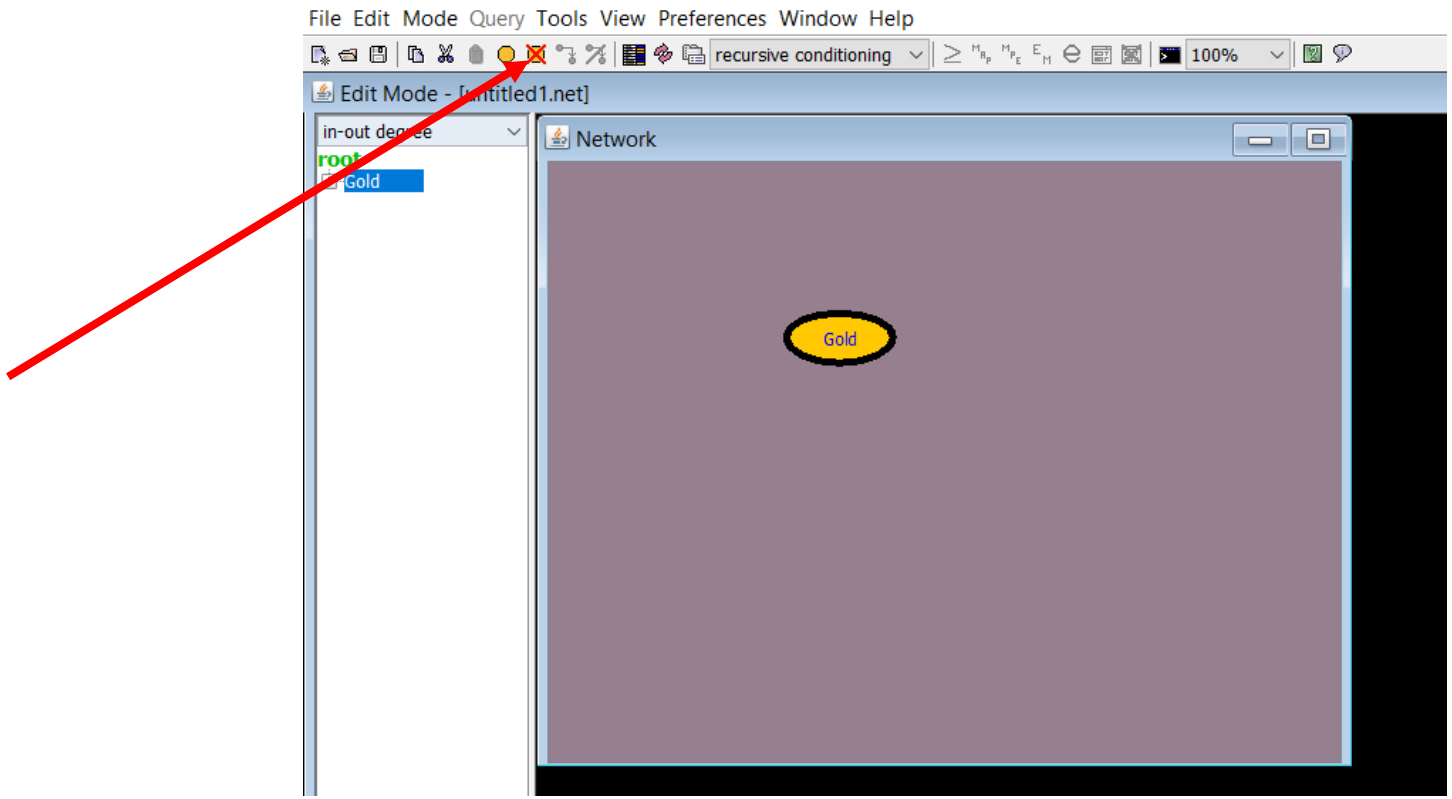
  - delete a node clicking on it with the right button of the mouse and selecting «Delete»

  - modify a node clicking on it with the right button of the mouse and selecting «Properties» or simply double-clicking on it.



Samlam Introduction

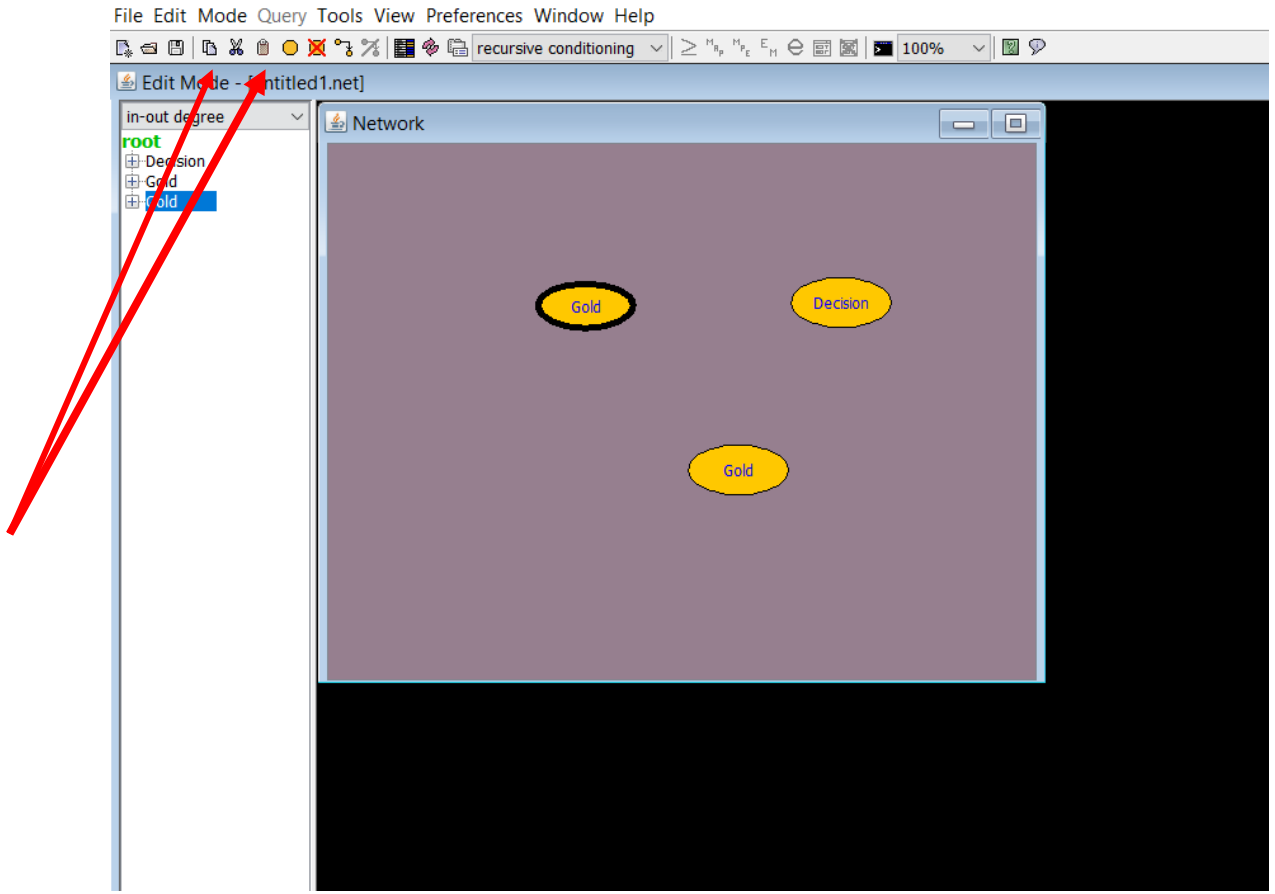
- You can delete a node also clicking on this button after node selection:



Samlam Introduction

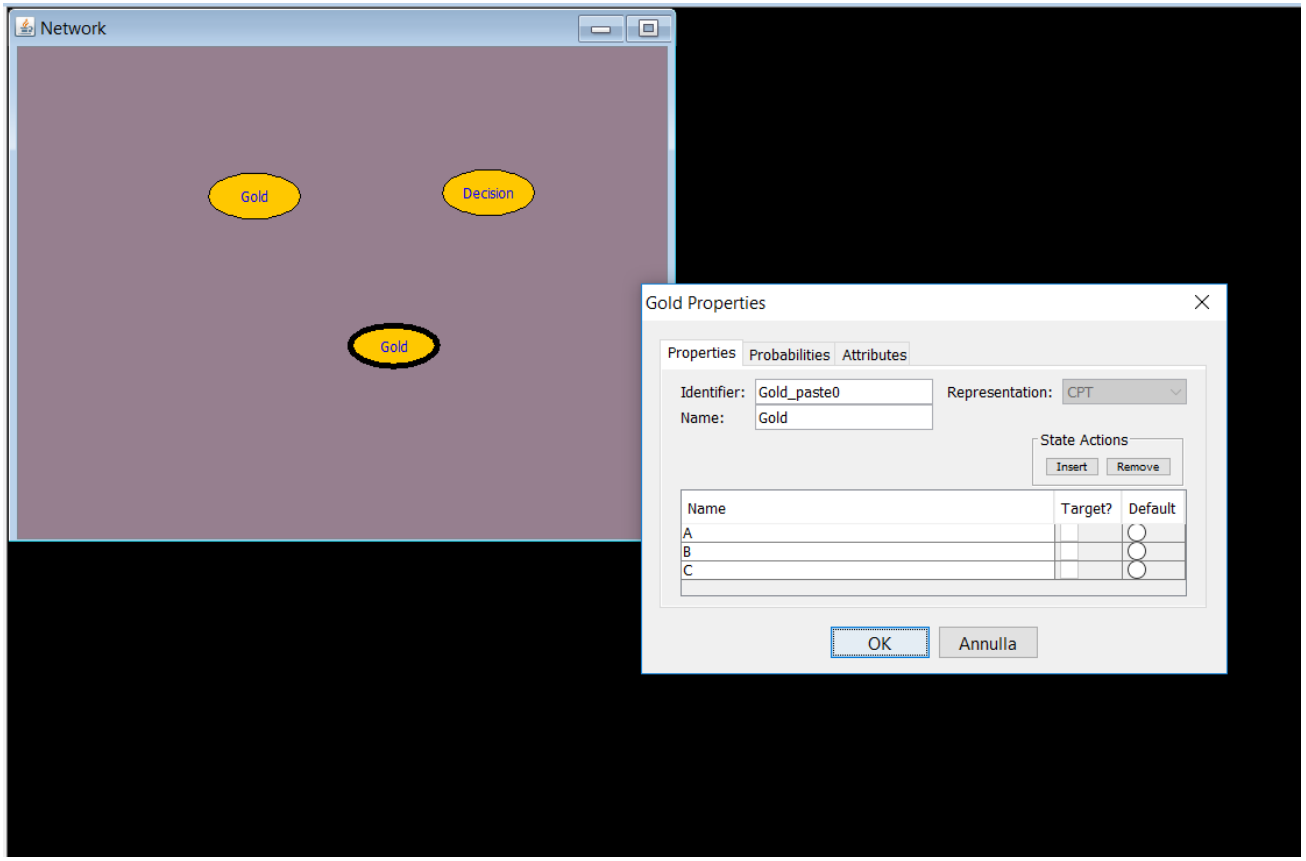
- You can also copy and paste a node and choosing its final location:

You can choose ctrl+c and ctrl+v or these buttons



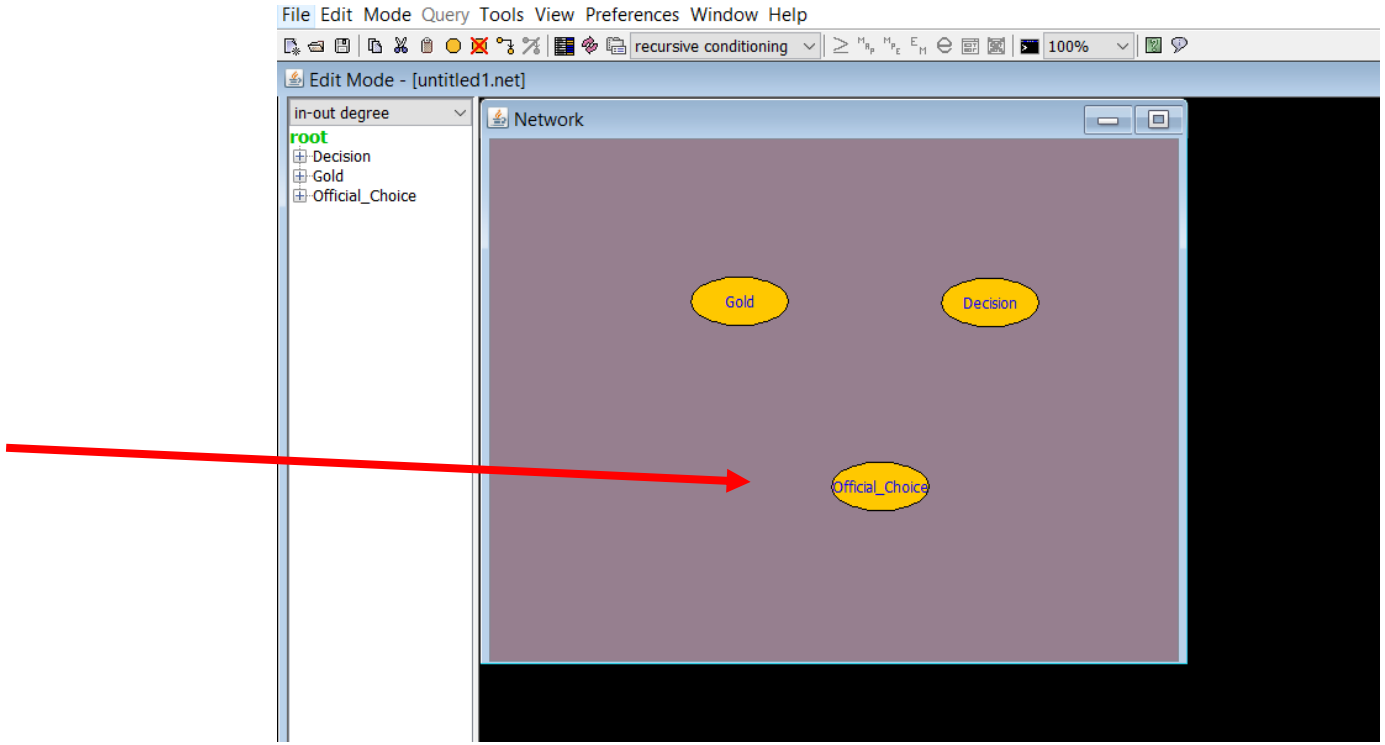
Samlam Introduction

- The new node has the same name, the same states (and same probabilities if you have already fixed them) but different Identifier:



Samlam Introduction

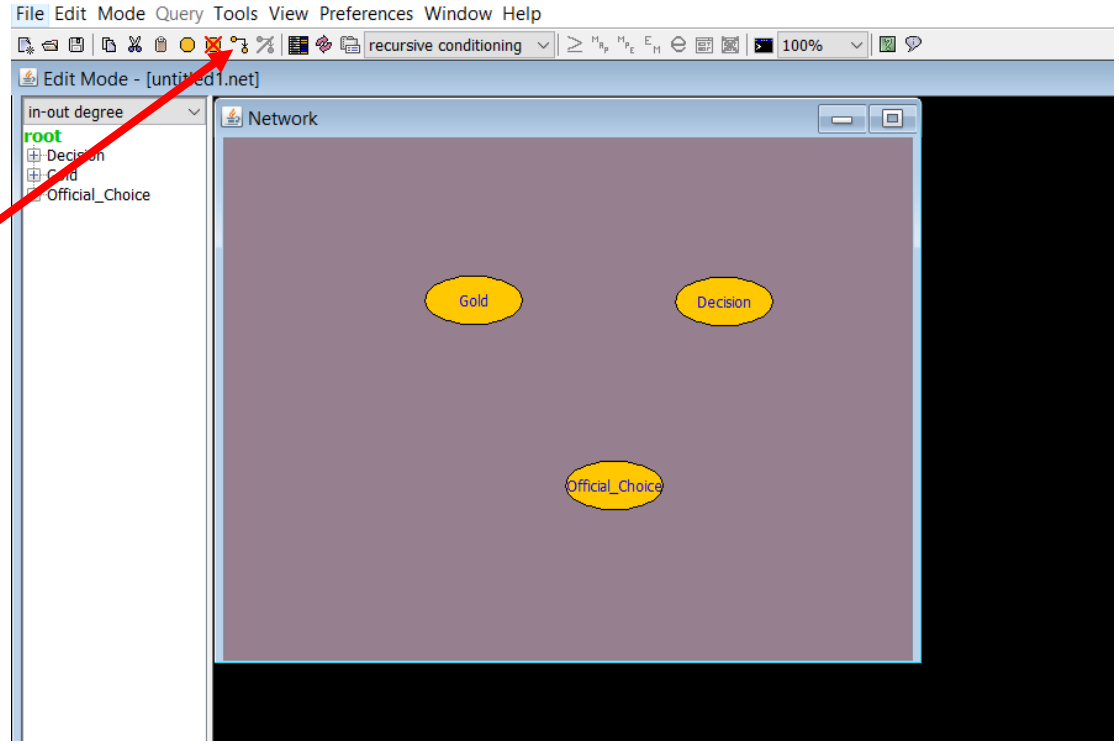
- Now you can modify some properties of the copied node to obtain what you want:



Samlam Introduction

- Now you can insert the influences between the nodes

You can click here to insert an edge between two nodes.
After clicking the button you must choose in order the nodes to connect.



Samlam Introduction

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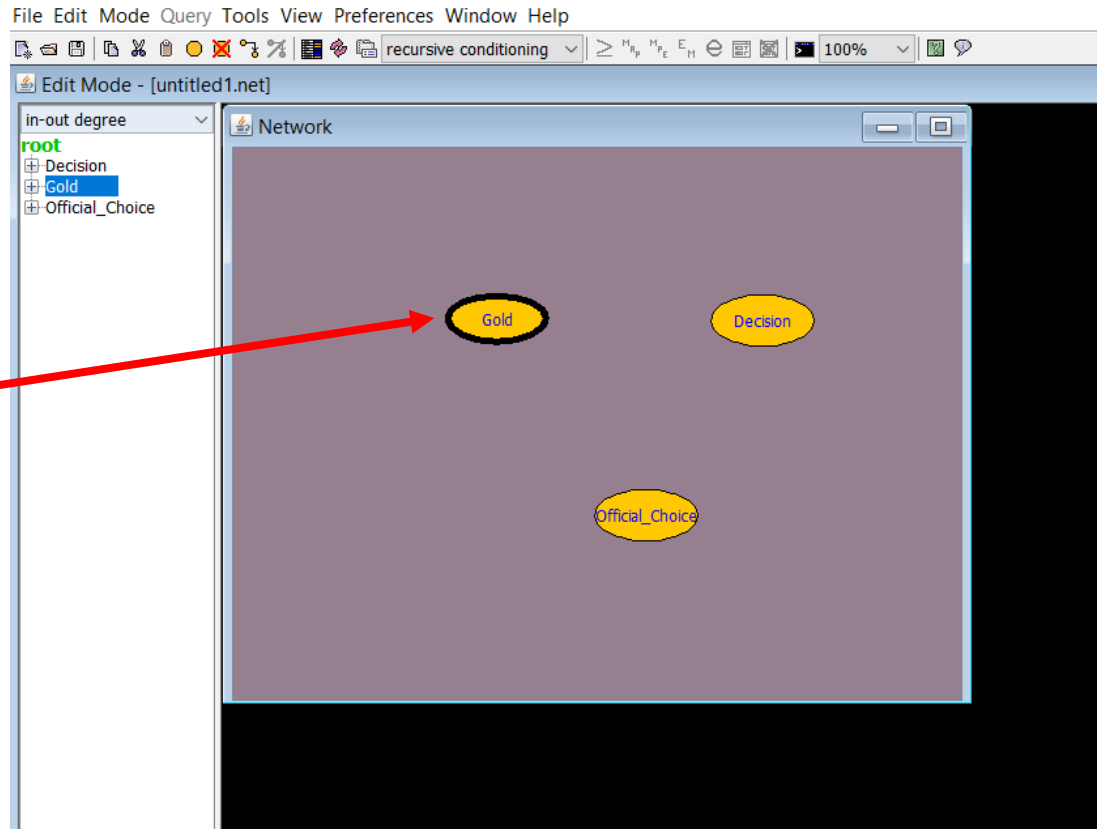

Samlam Introduction

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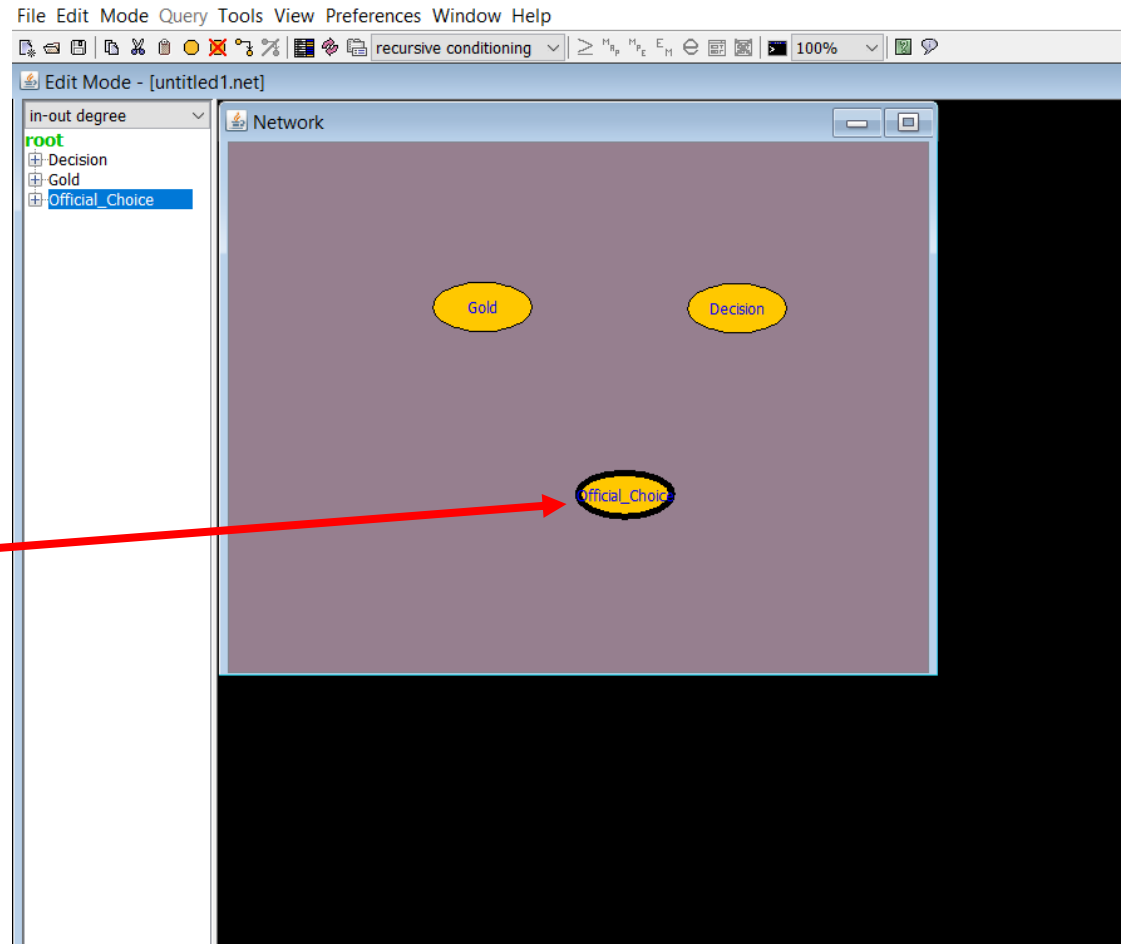
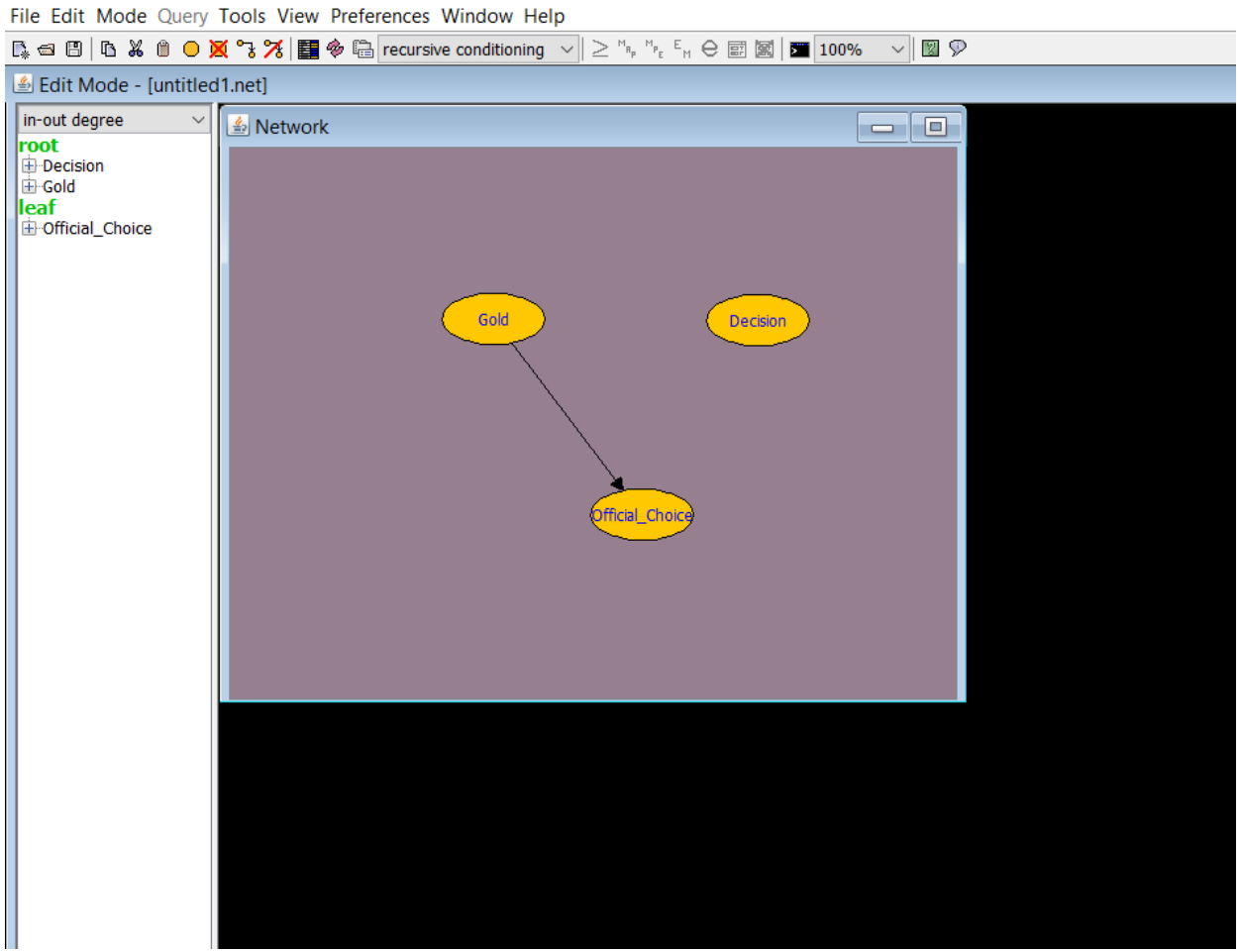


Samlam Introduction

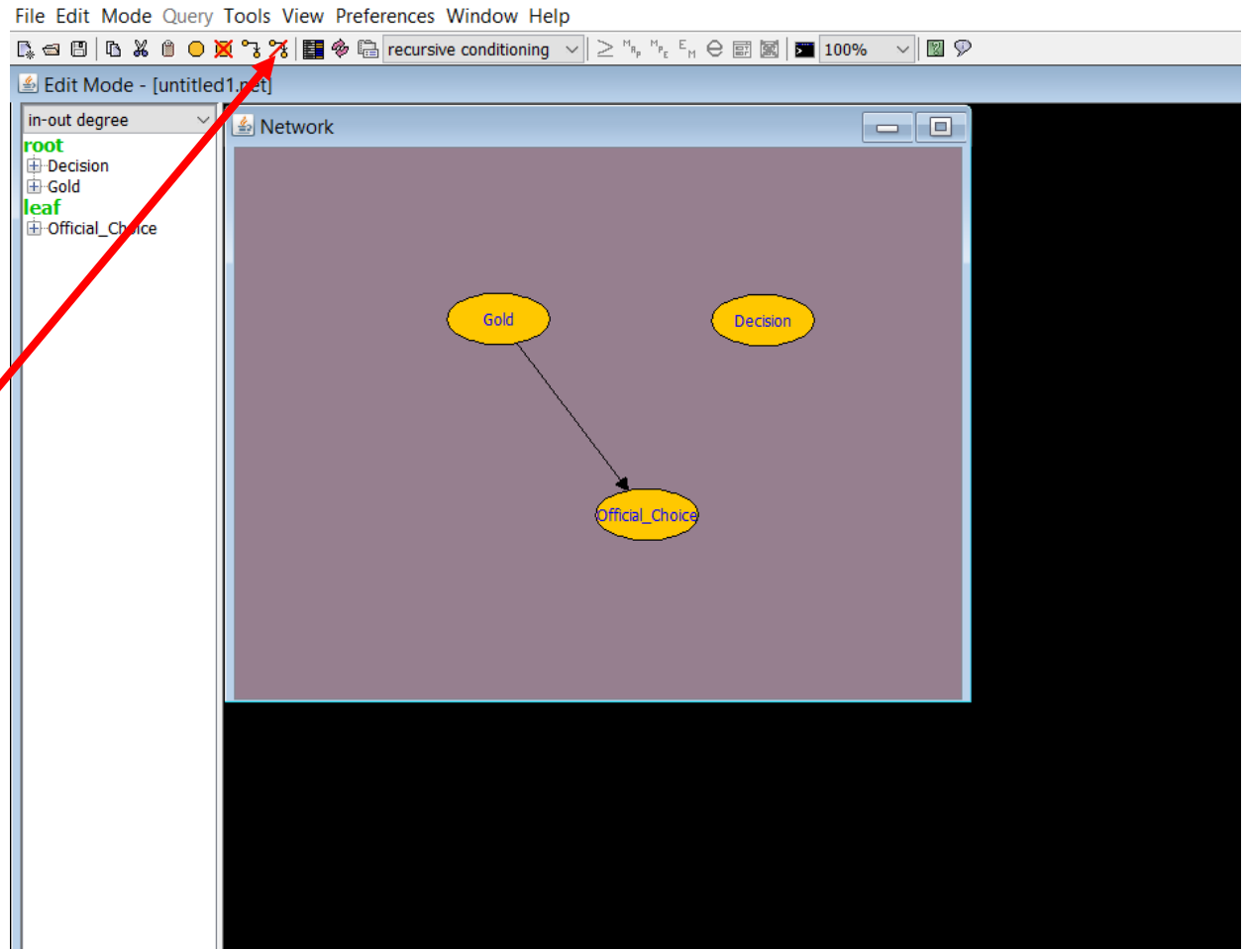
- Now you have the edge!



Samlam Introduction

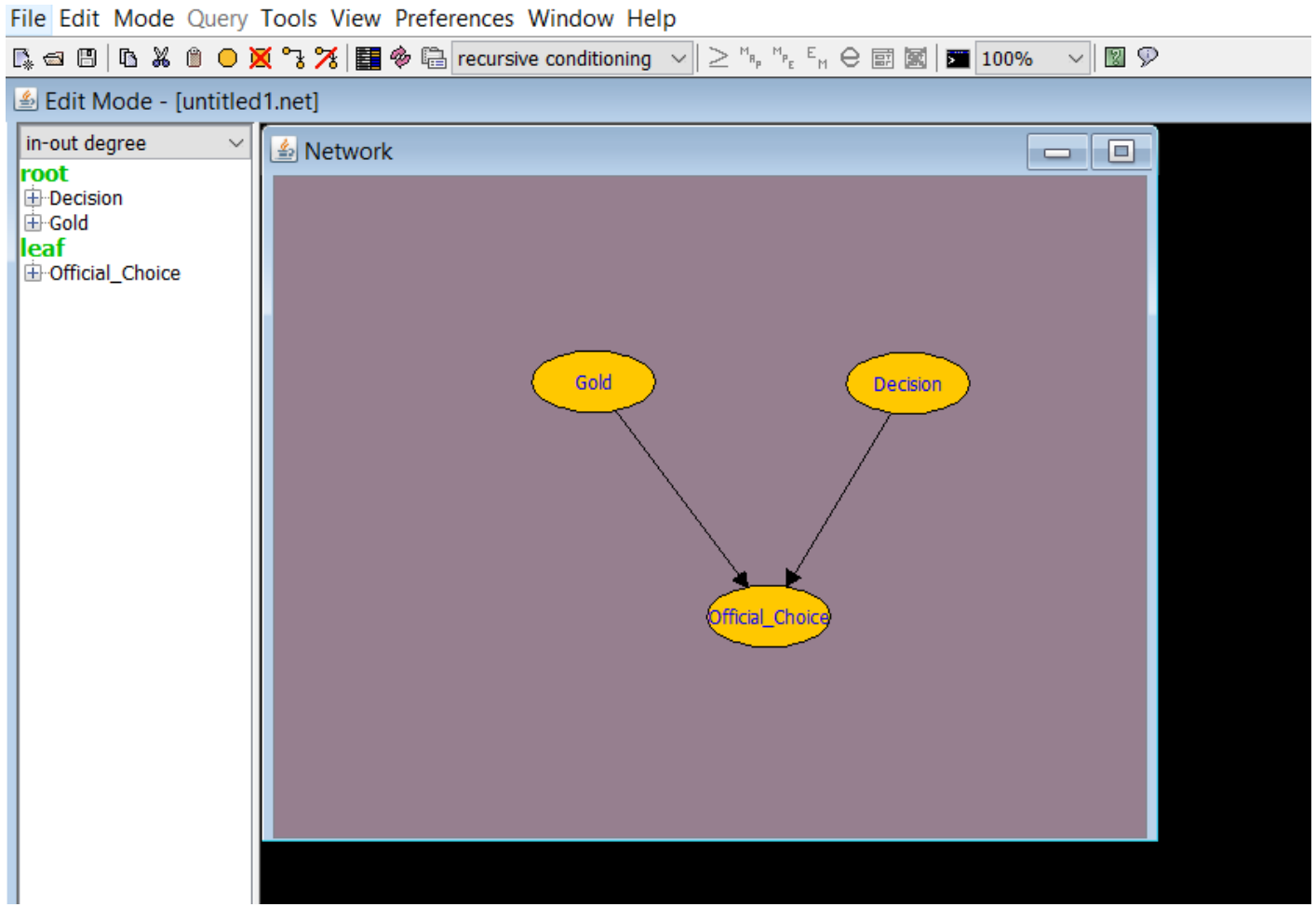
- You can also delete an edge:

To delete an edge you must click on this button and repeating the procedure (select in order the nodes between them you want to delete the edge)



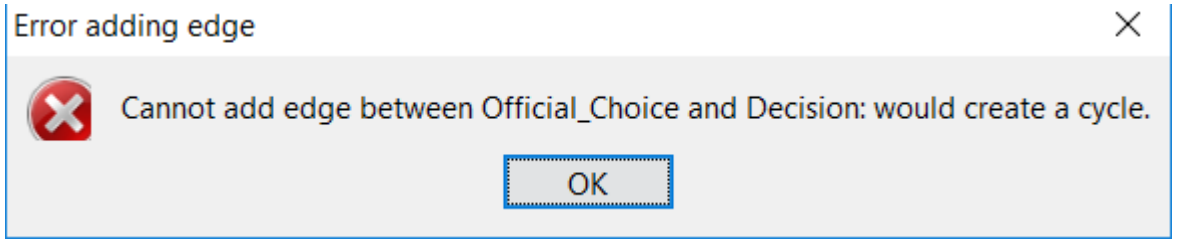
Samlam Introduction

- In the way presented before you can insert all the edges you want in your network:



Samlam Introduction

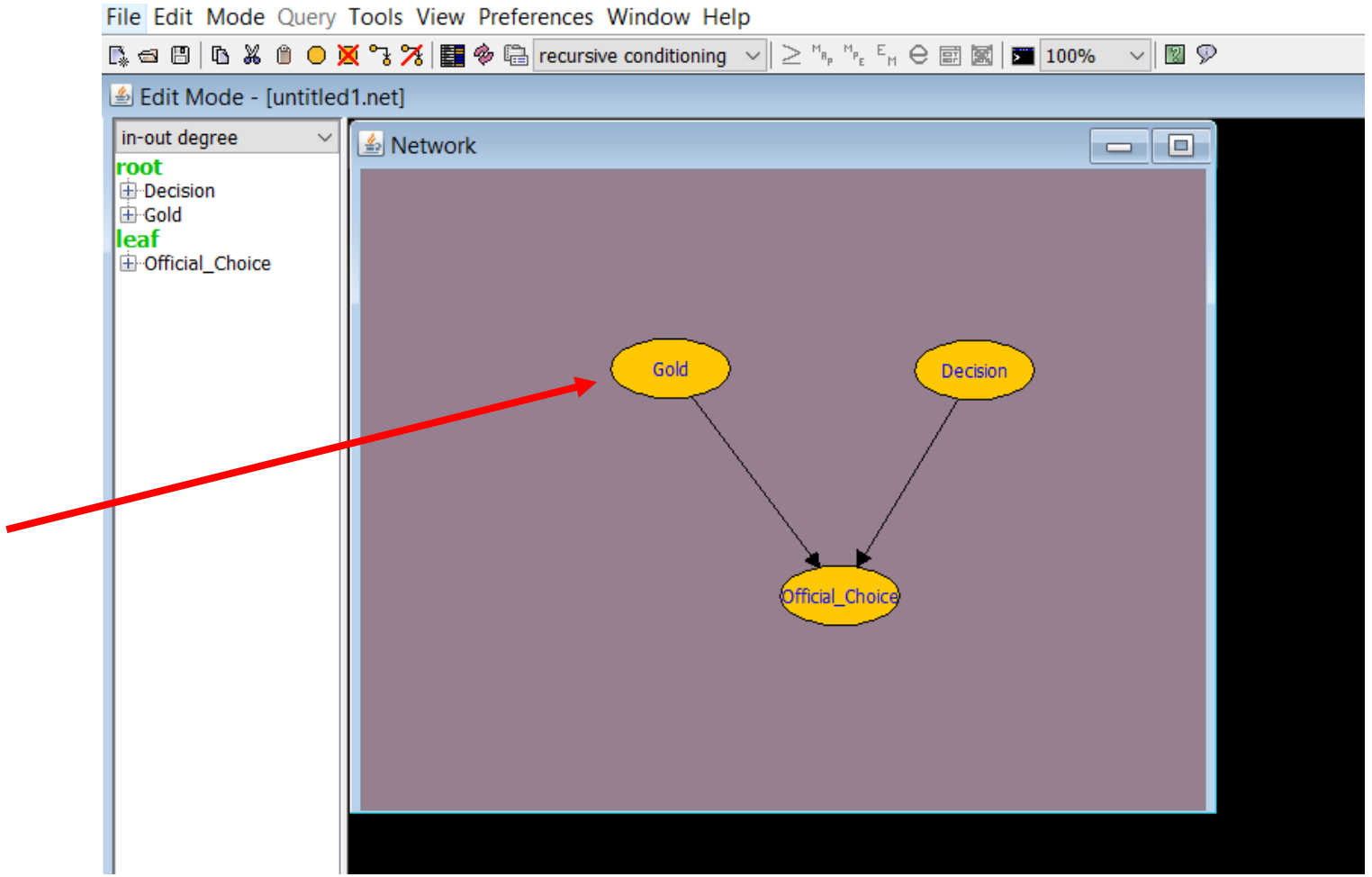
- The program prevents you to create cycles:



Samlam Introduction

- Now you can insert the CPT in every node of your network:

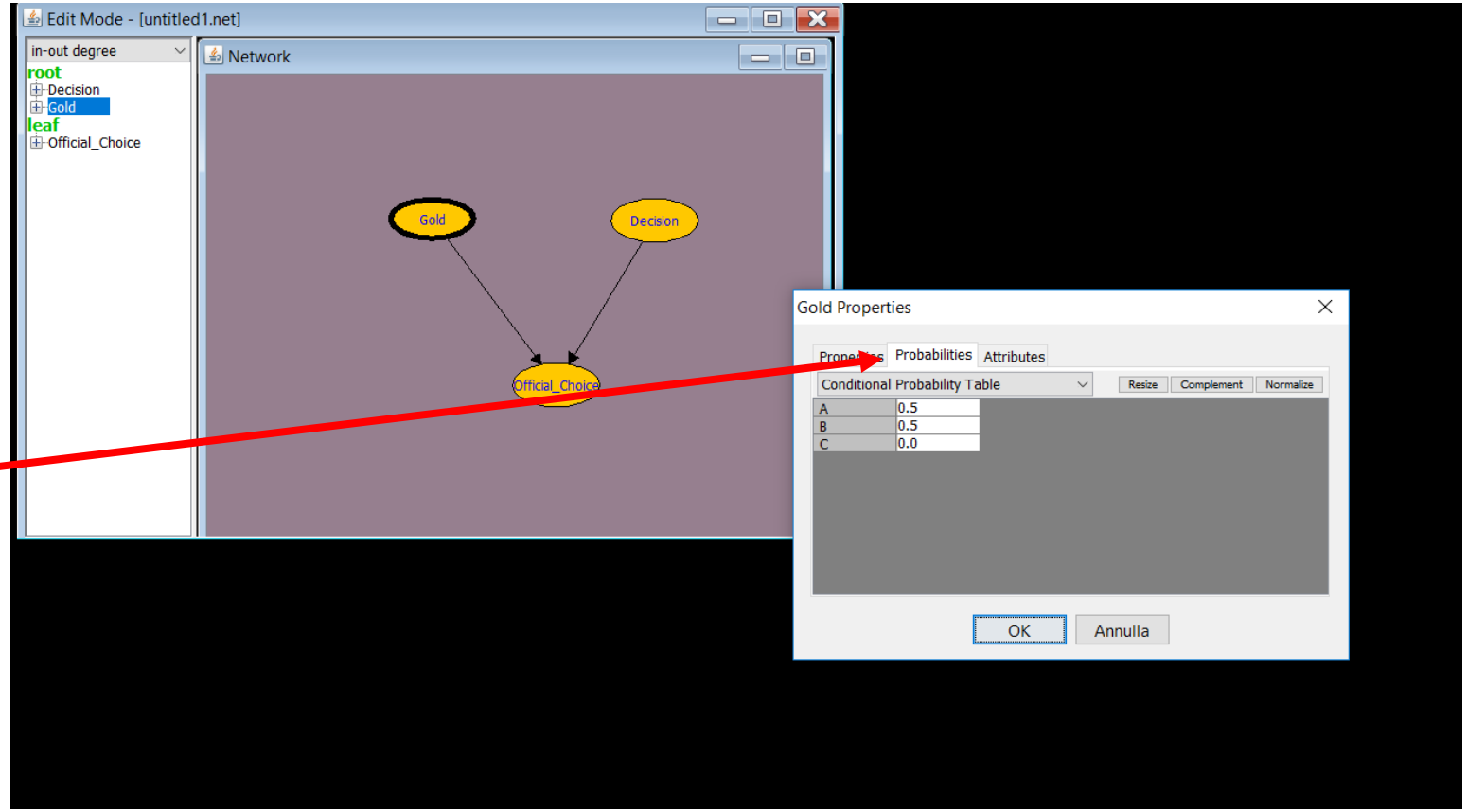
Double-clicking on a node you can see its properties and fix its CPT clicking on the pane «probabilities»



Samlam Introduction

- Now you can insert the CPT in every node of your network:

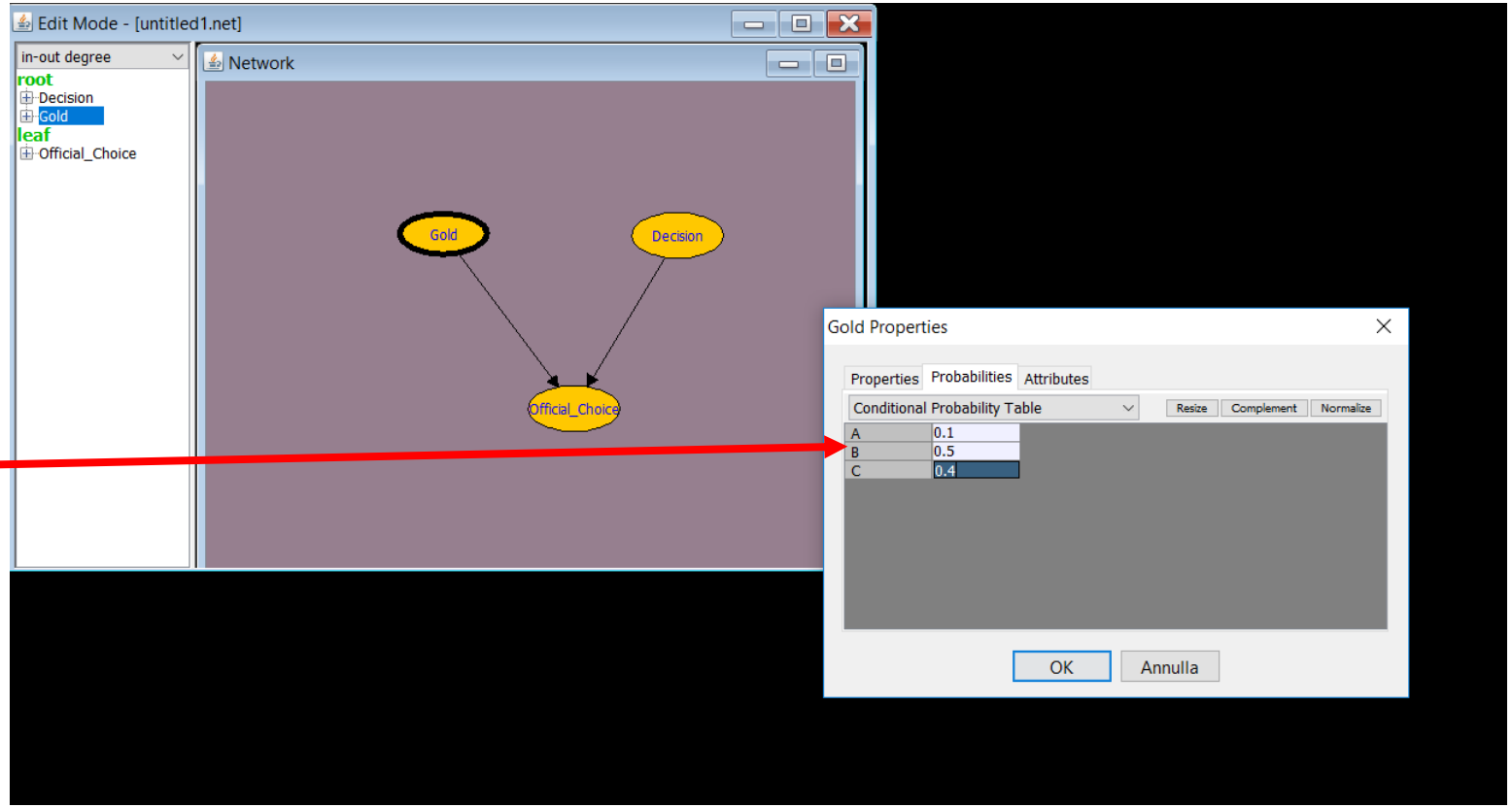
Here you can modify the default probabilities presents in the CPT



Samlam Introduction

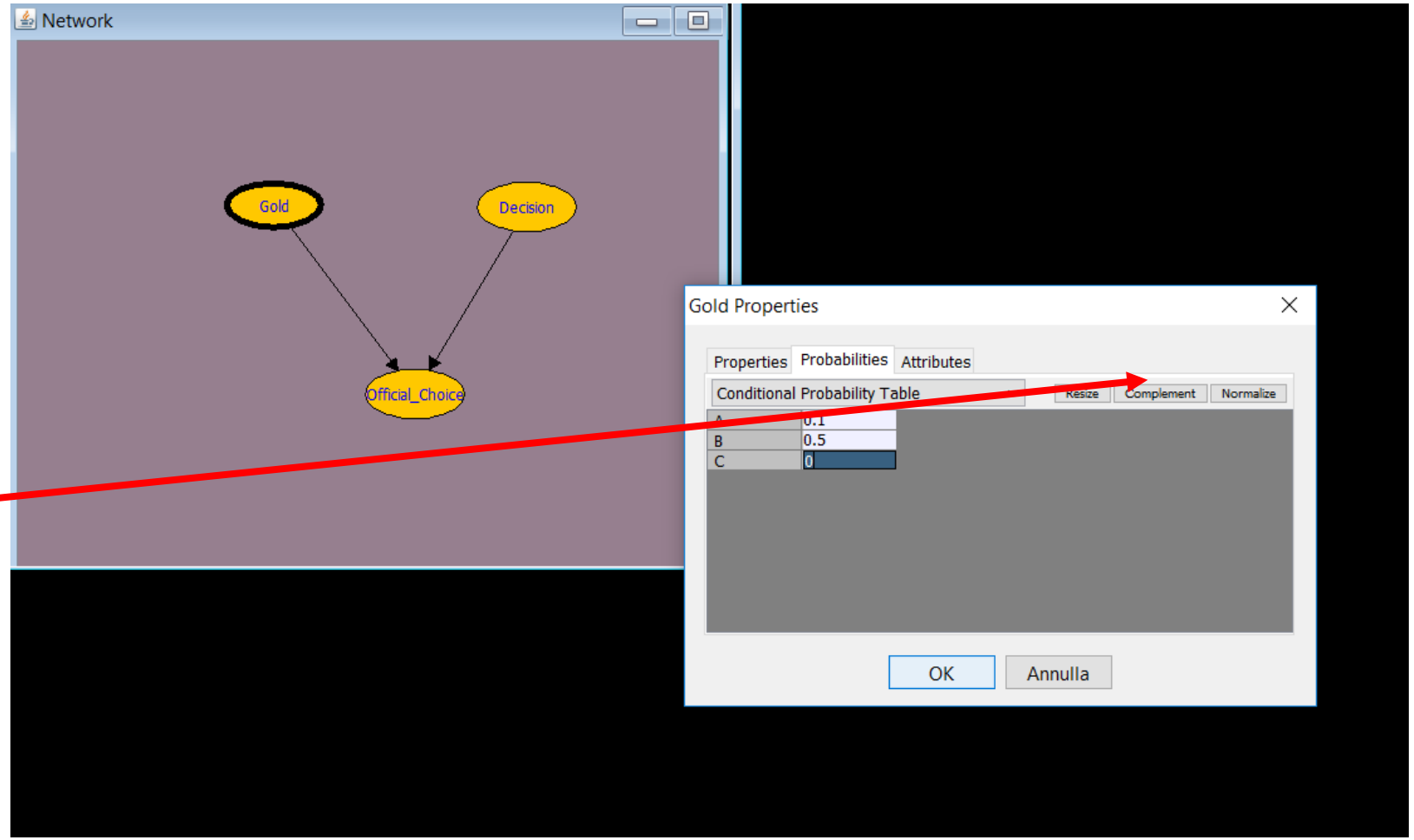
- Now you can insert the CPT in every node of your network:

You can choose to insert manually all the values



Samlam Introduction

- Now you can insert the CPT in every node of your network:

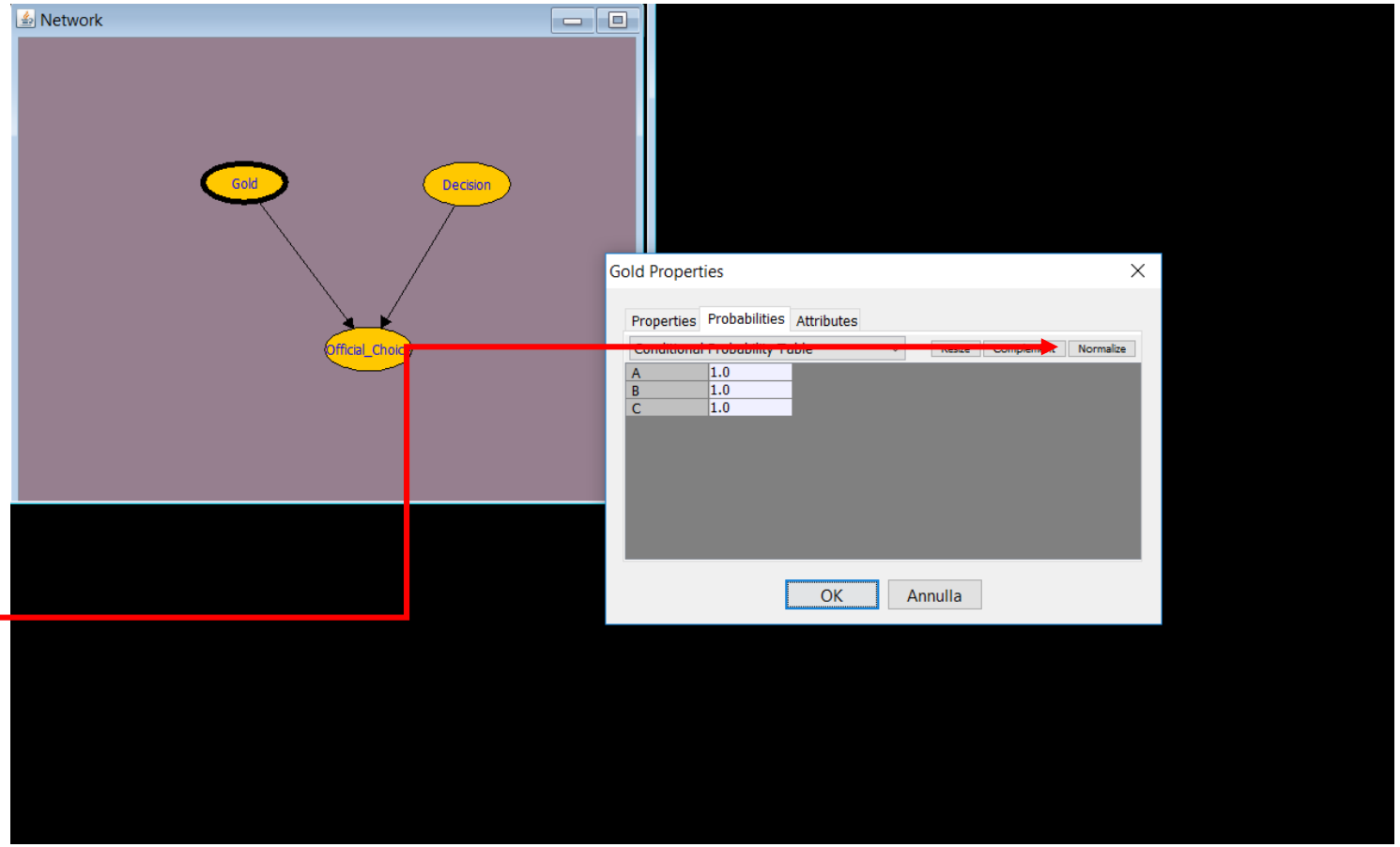


You can choose to insert manually all the values except one and then click on «Complement» to complete the table

Samlam Introduction

- Now you can insert the CPT in every node of your network:

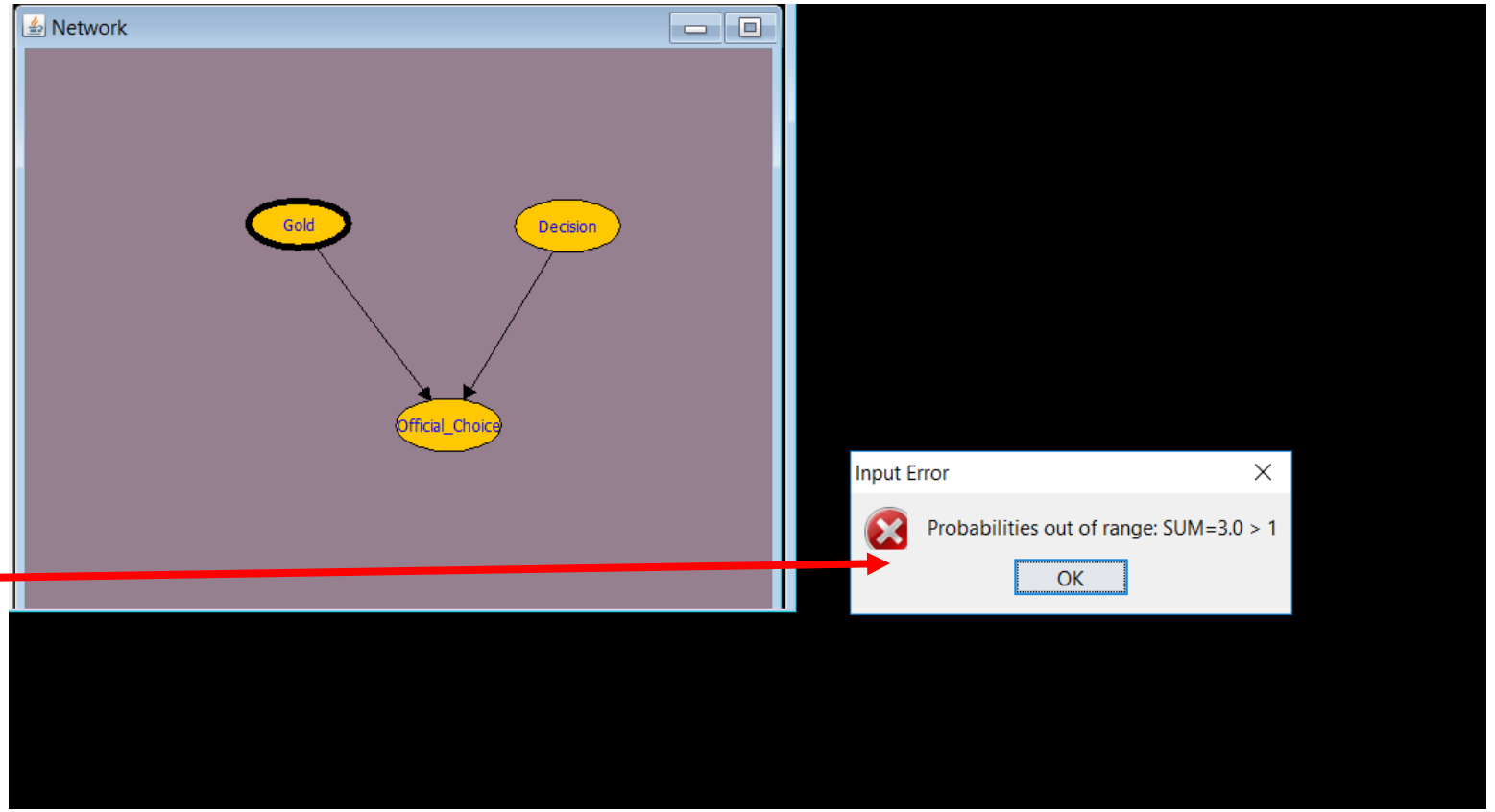
Or you can choose to insert the proportions of the values and the click on «Normalize» to obtain the exact probabilities



Samlam Introduction

- Now you can insert the CPT in every node of your network:

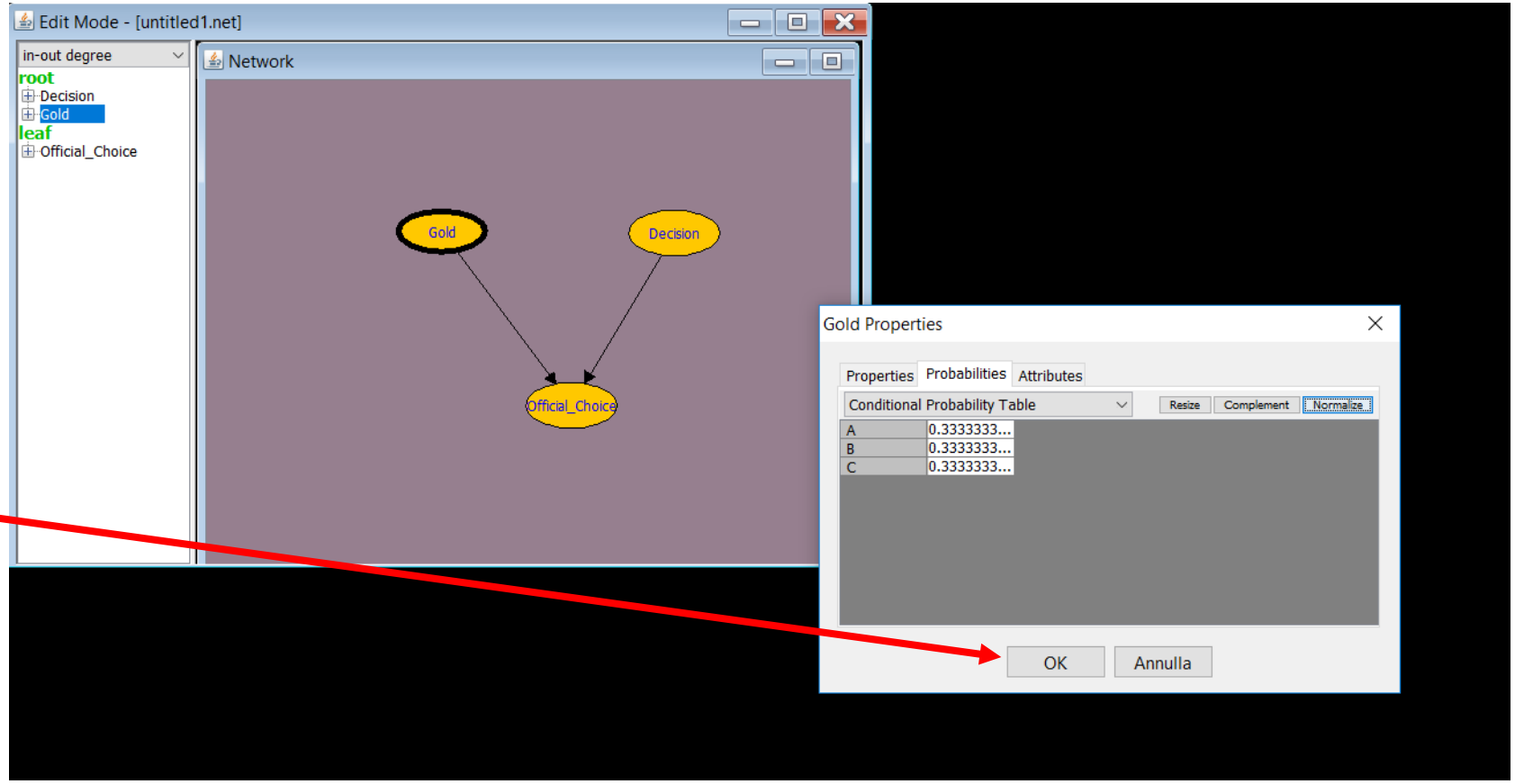
If you insert values that are not probabilities (because they are negative values or they do not add up to one) and try to save them clicking on the button «OK» samiam warns you!



Samlam Introduction

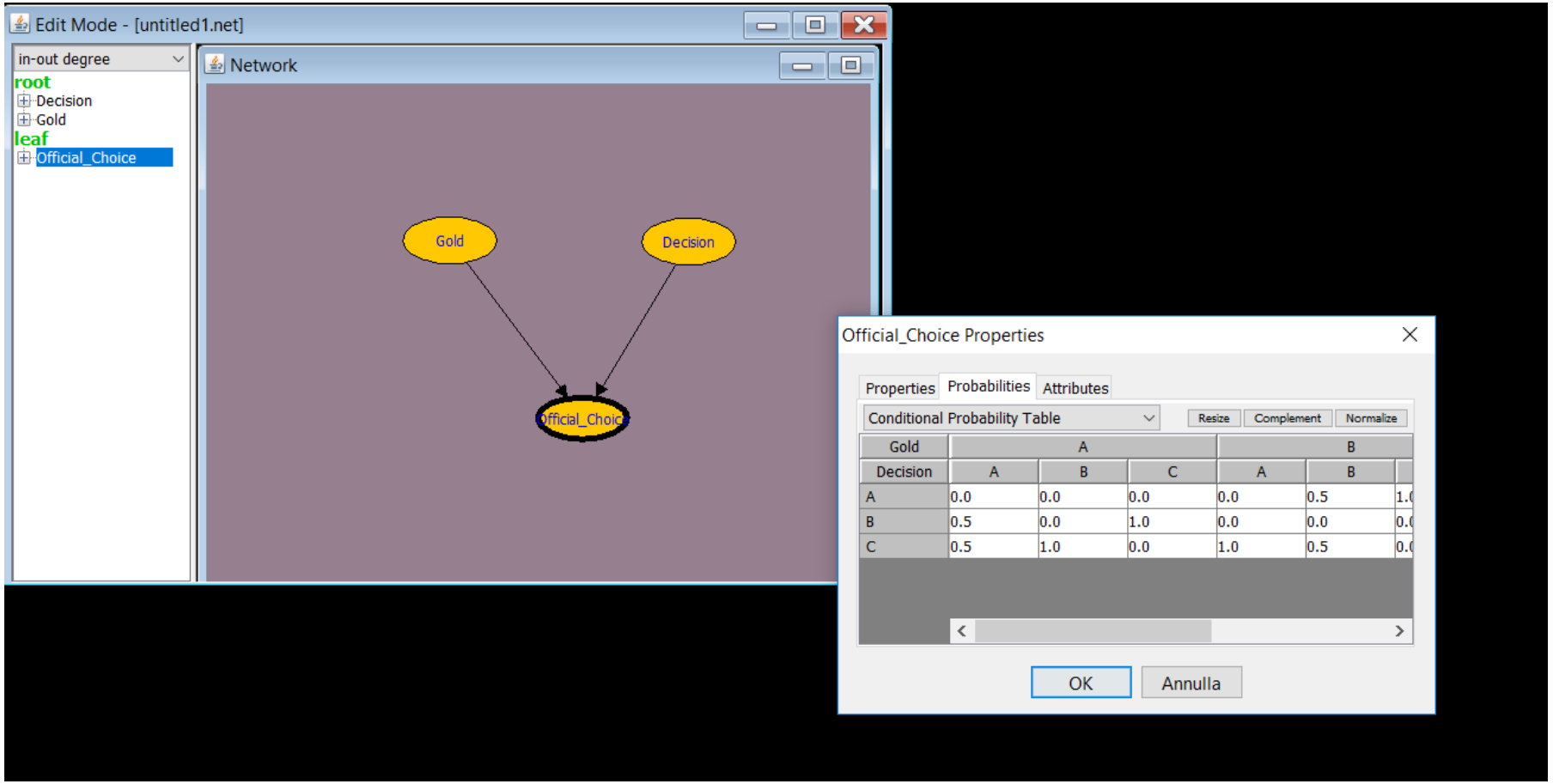
- Now you can insert the CPT in every node of your network::

Now you can click on «OK» and save the values



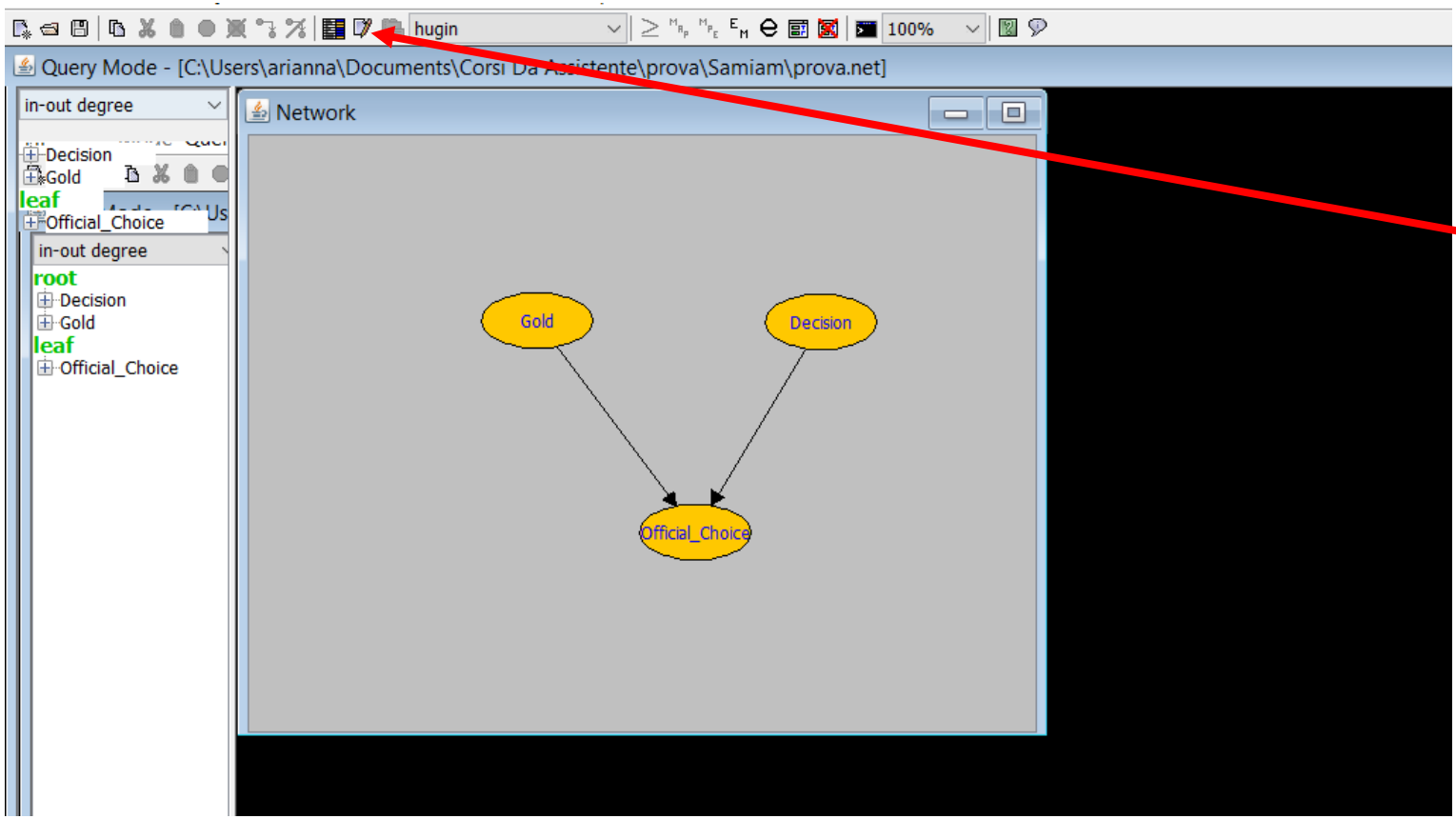
Samlam Introduction

- You can repeat the procedure for every node:



Samlam Introduction

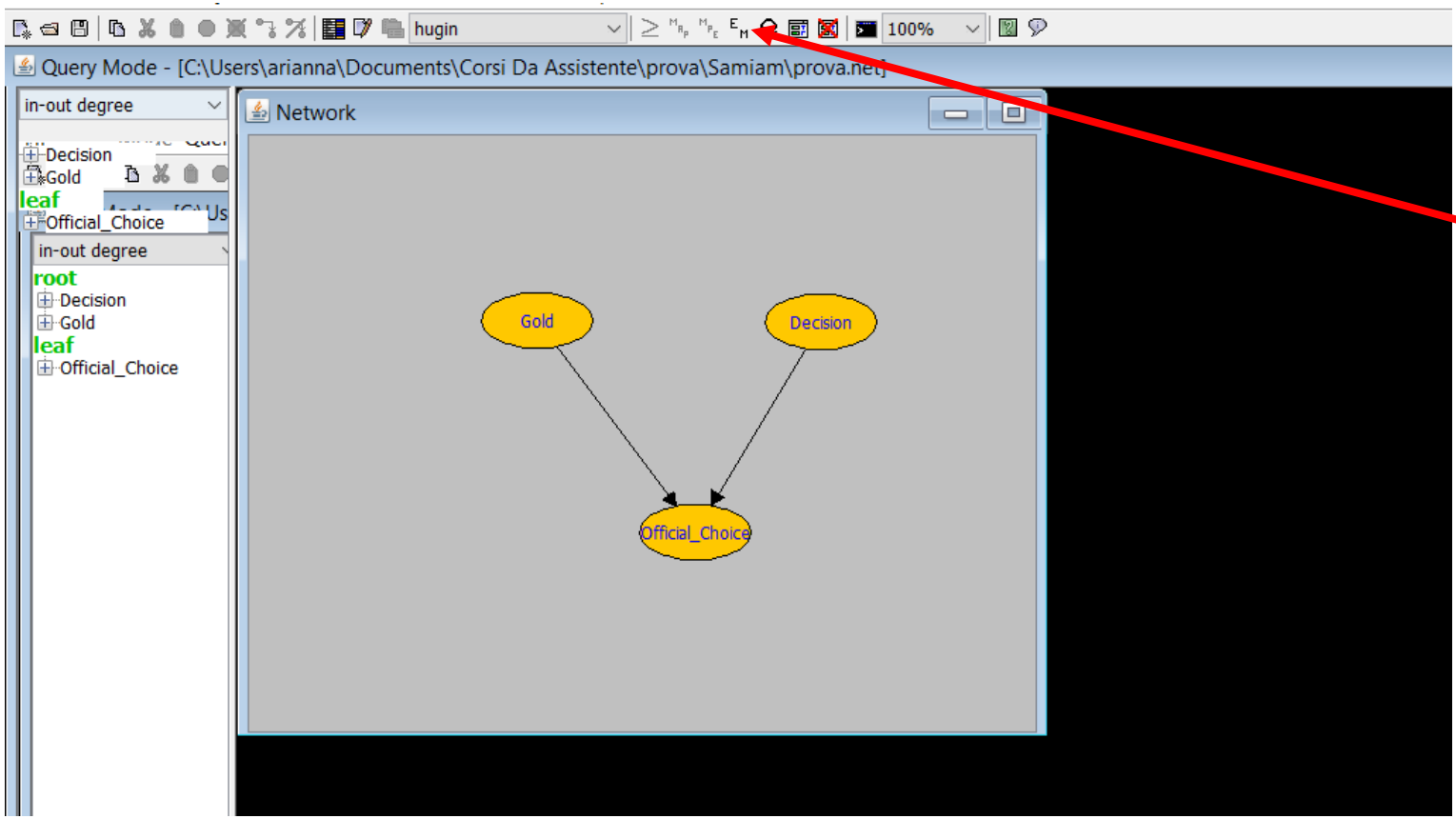
- You can also insert a dataset and let Samiam learn CPTs:



You must pass on «Query» mode Clicking this button (we will see later this mode in more detail)

Samlam Introduction

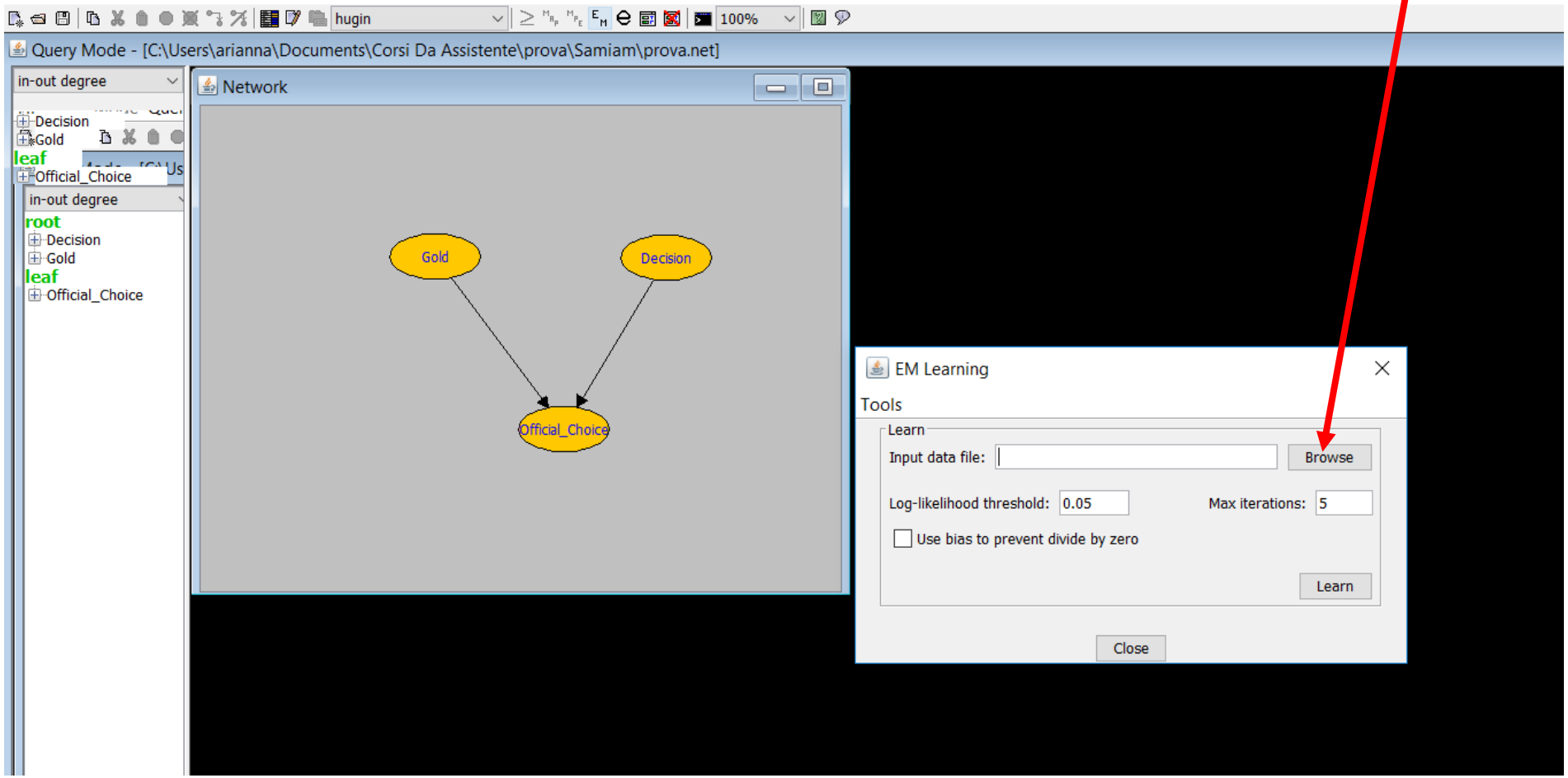
- You can also insert a dataset and let Samiam learn CPTs:



Samlam Introduction

- You can also insert a dataset and let Samiam learn CPTs:

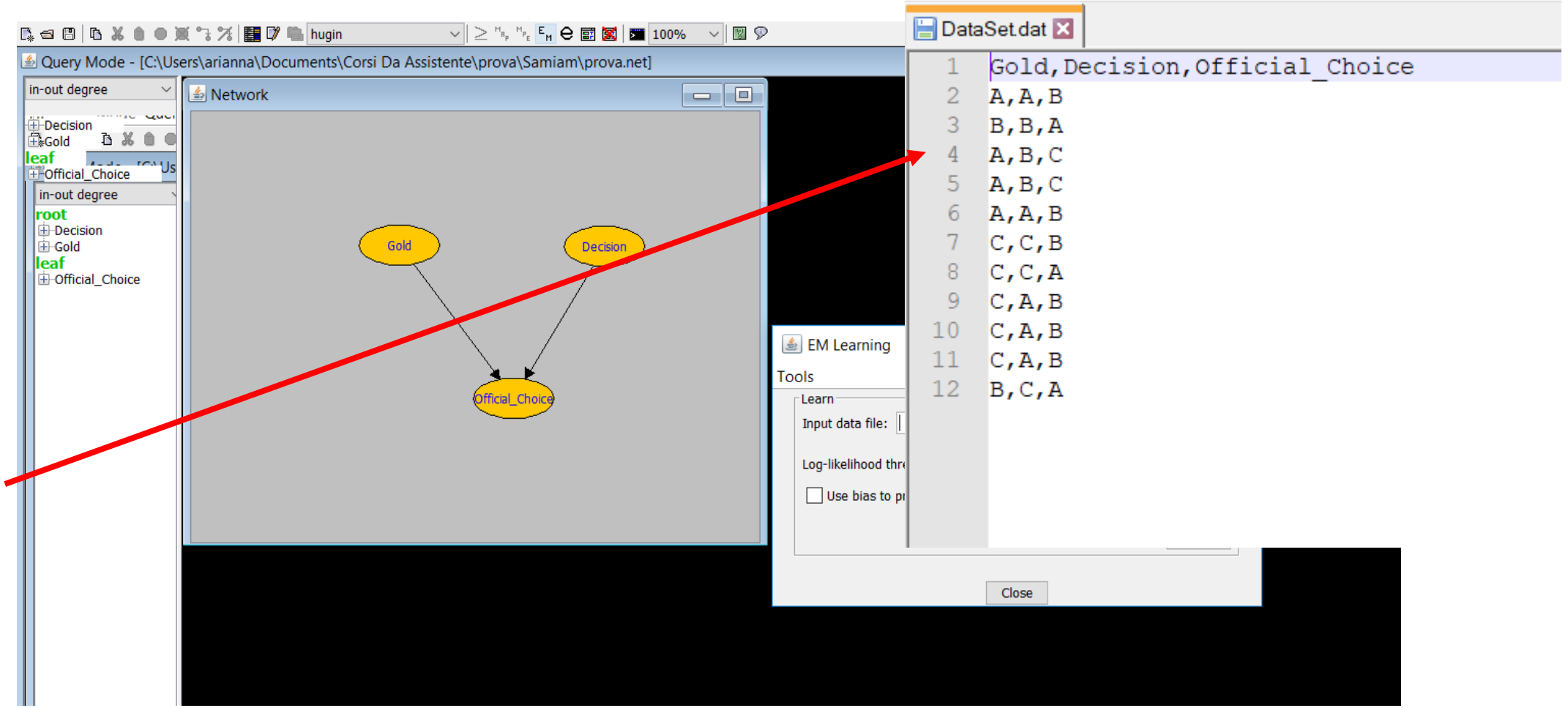
Choose file .dat containing the dataset



Samlam Introduction

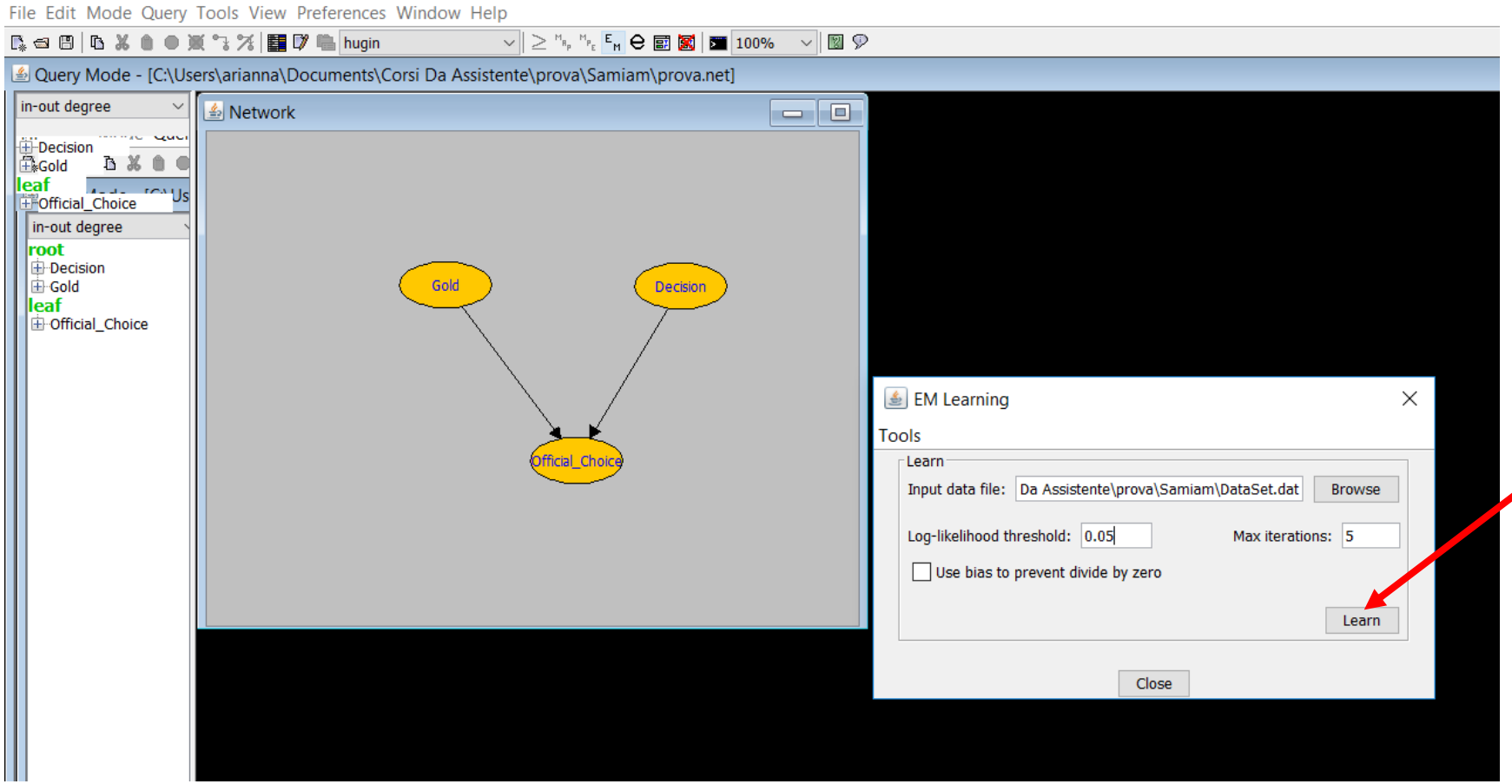
- You can also insert a dataset and let Samiam learn CPTs:

It's a text file of this format. It must contain values for all variables of the network. It can contain some missing values indicated with N/A.



Samlam Introduction

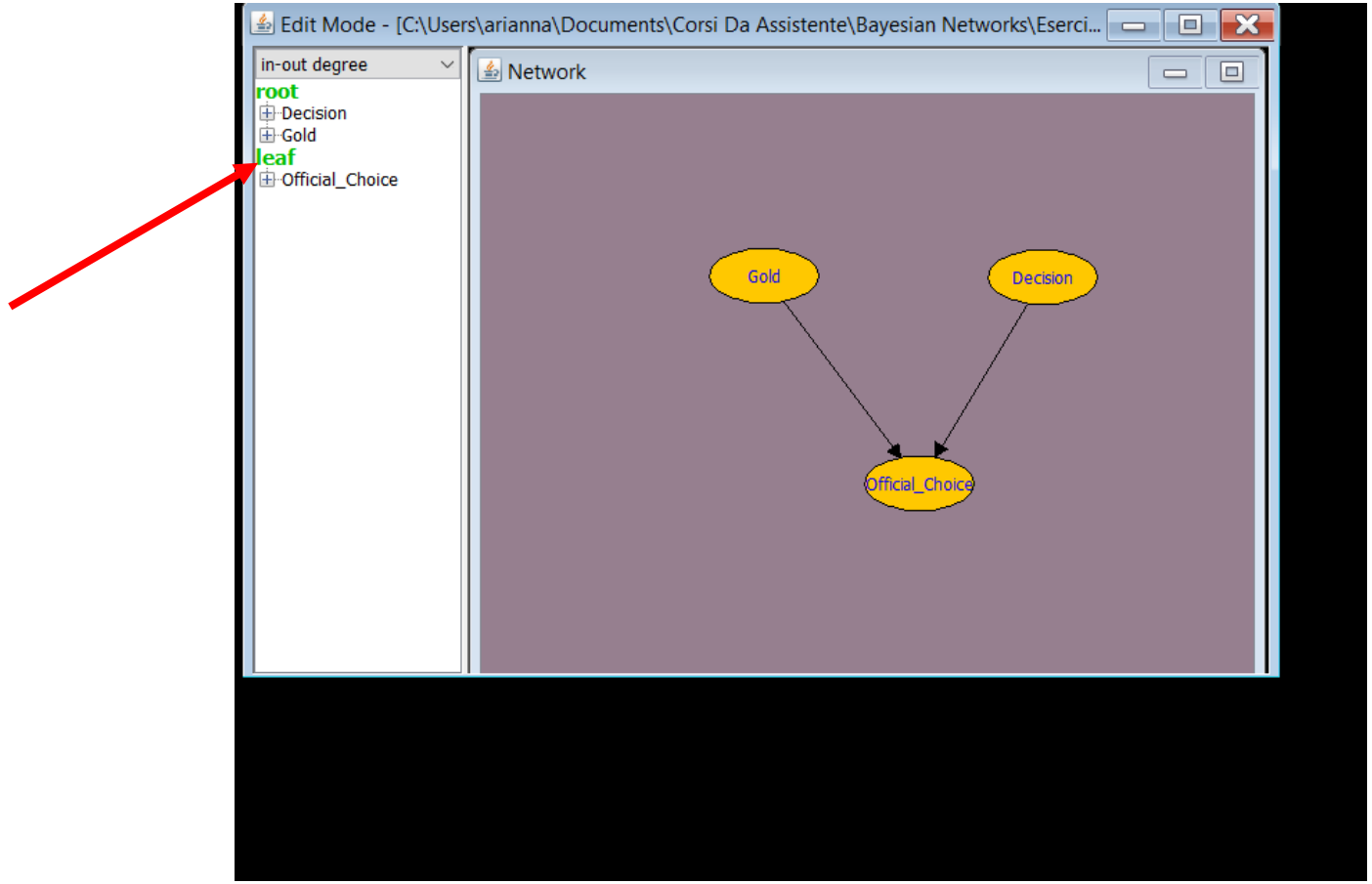
- You can also insert a dataset and let Samiam learn CPTs:



Then you must click «Learn» and you can find the updated values in the CPTs.

Samlam Introduction

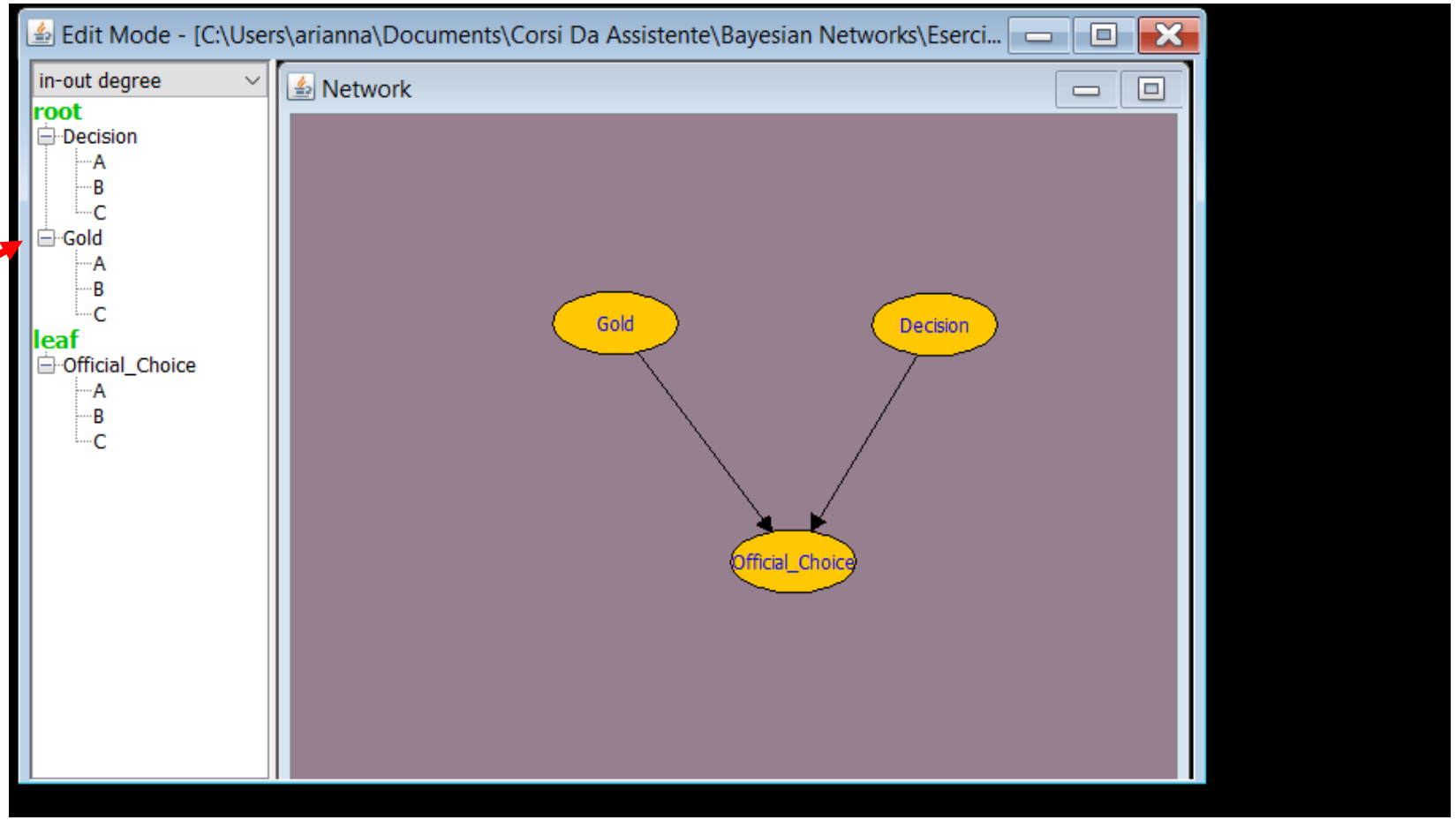
- You can see the structure of your network in the left-panel:



Samlam Introduction

- You can see the structure of your network in the left-panel:

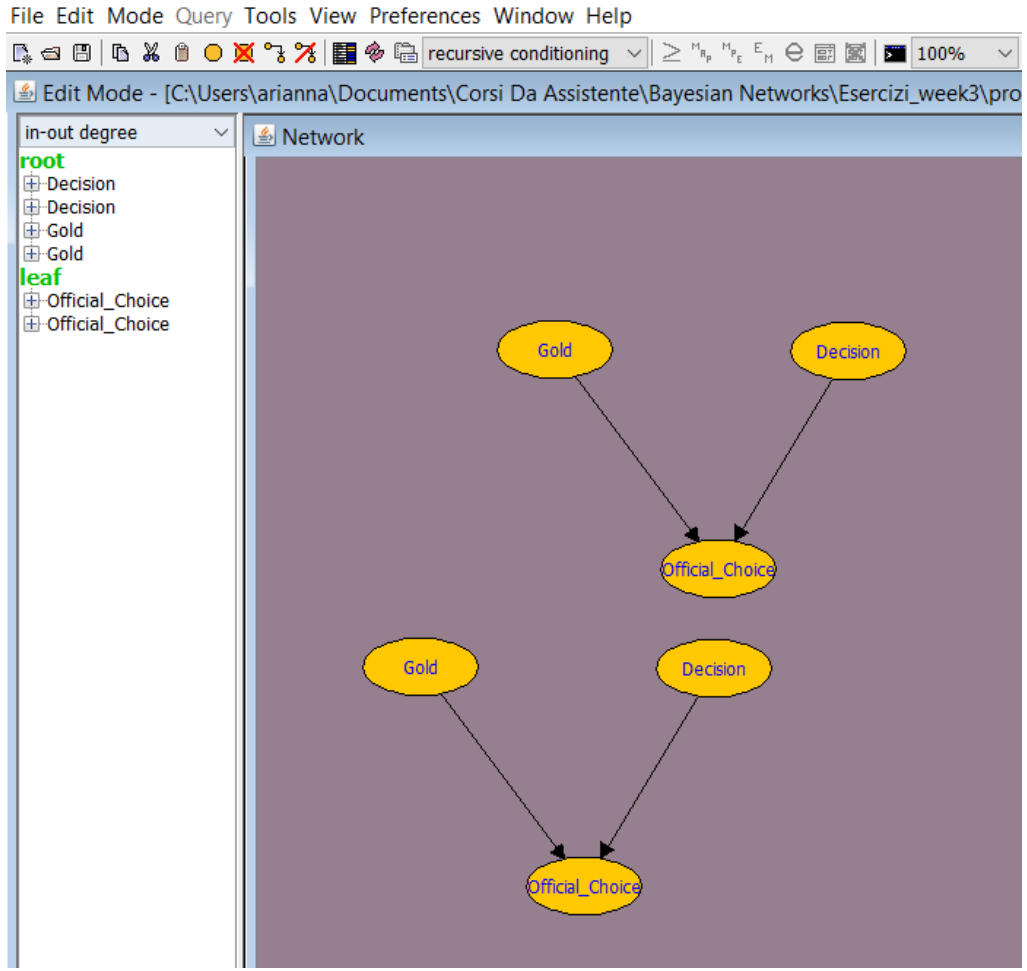
You can also expand it and see the states of each variable



Samlam Introduction

- You can also copy your network:

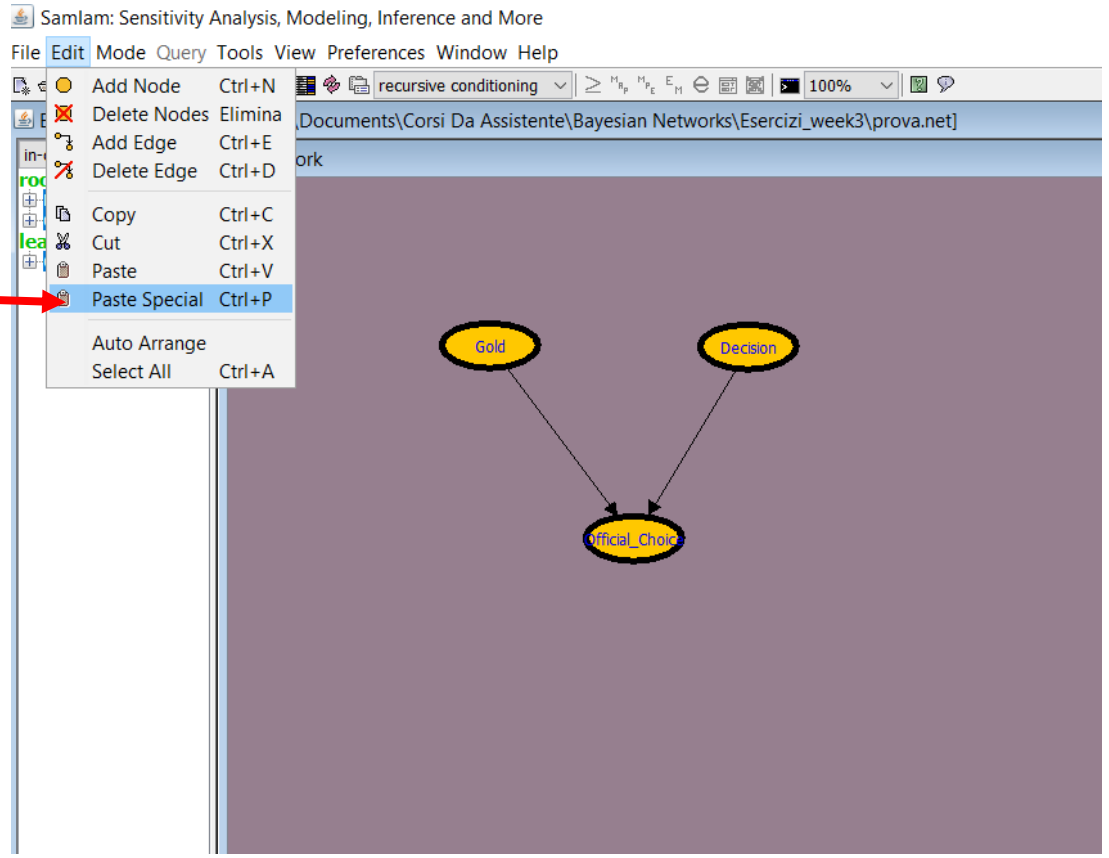
You can select all the network and copy it. This new network is equal to the first one (same nodes with same names – different identifiers, same edges and same CPTs)



Samlam Introduction

- You can also copy your network:

You can choose to paste only the nodes with Edit -> Paste Special



Samlam Introduction

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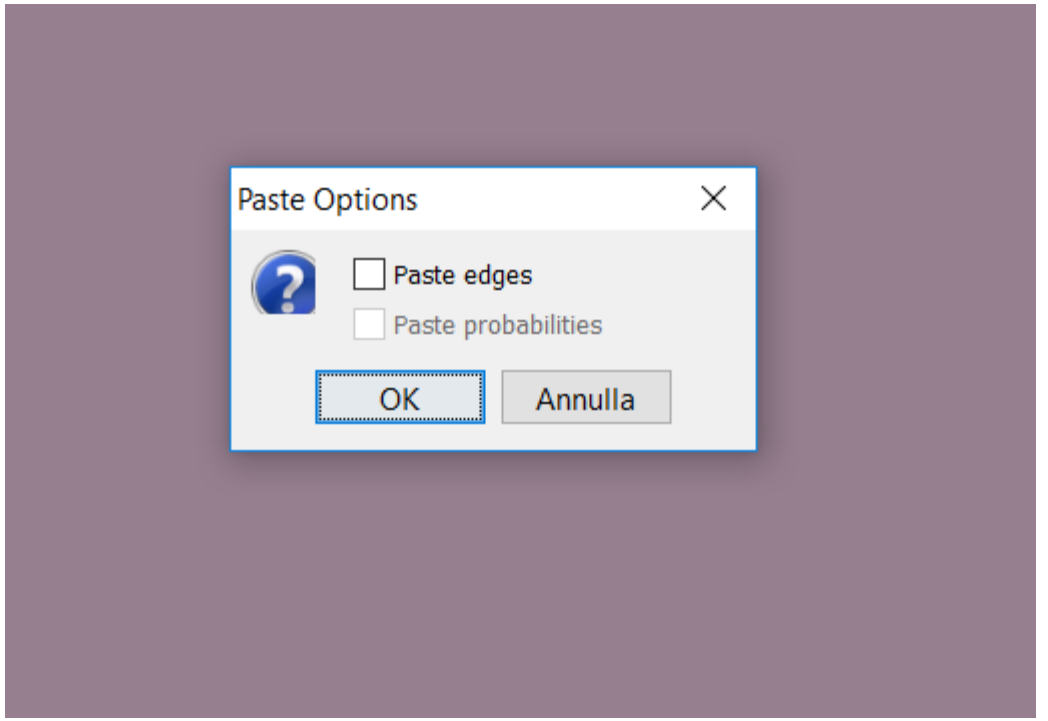
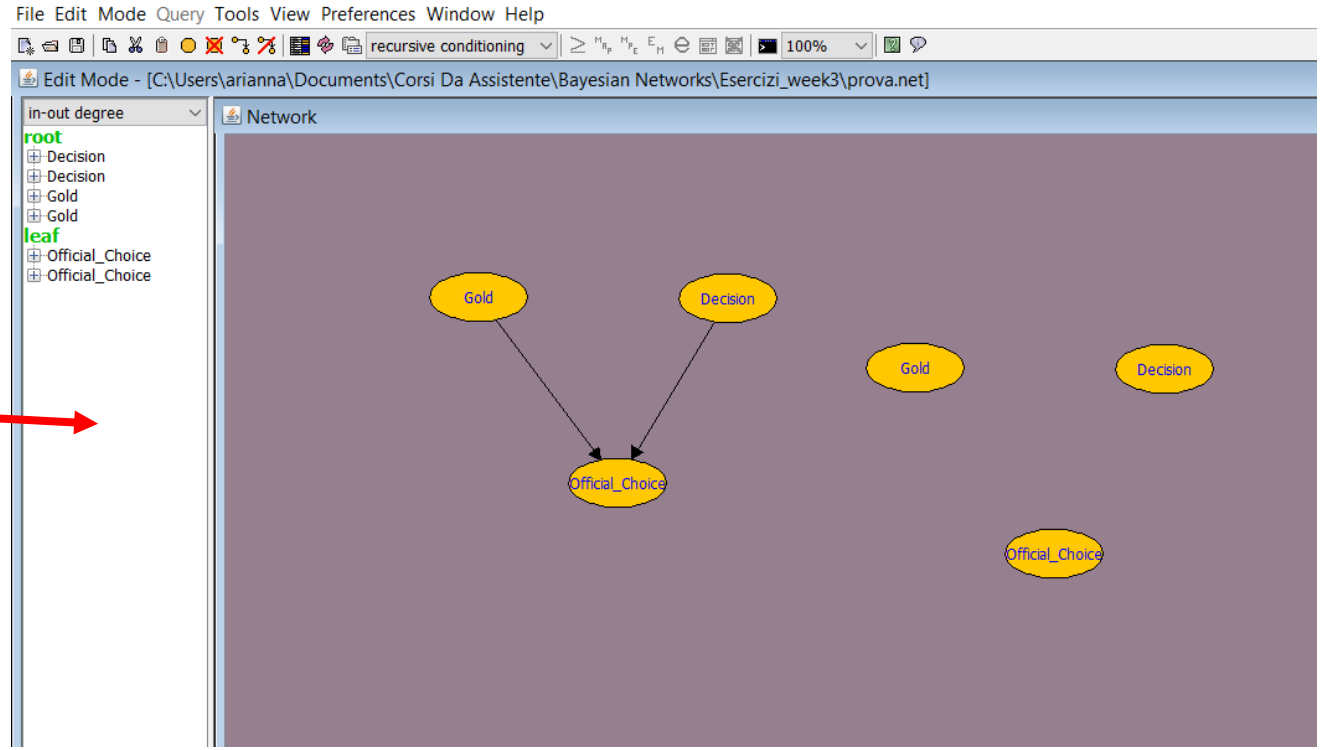


Samlam Introduction

- You can also copy your network:

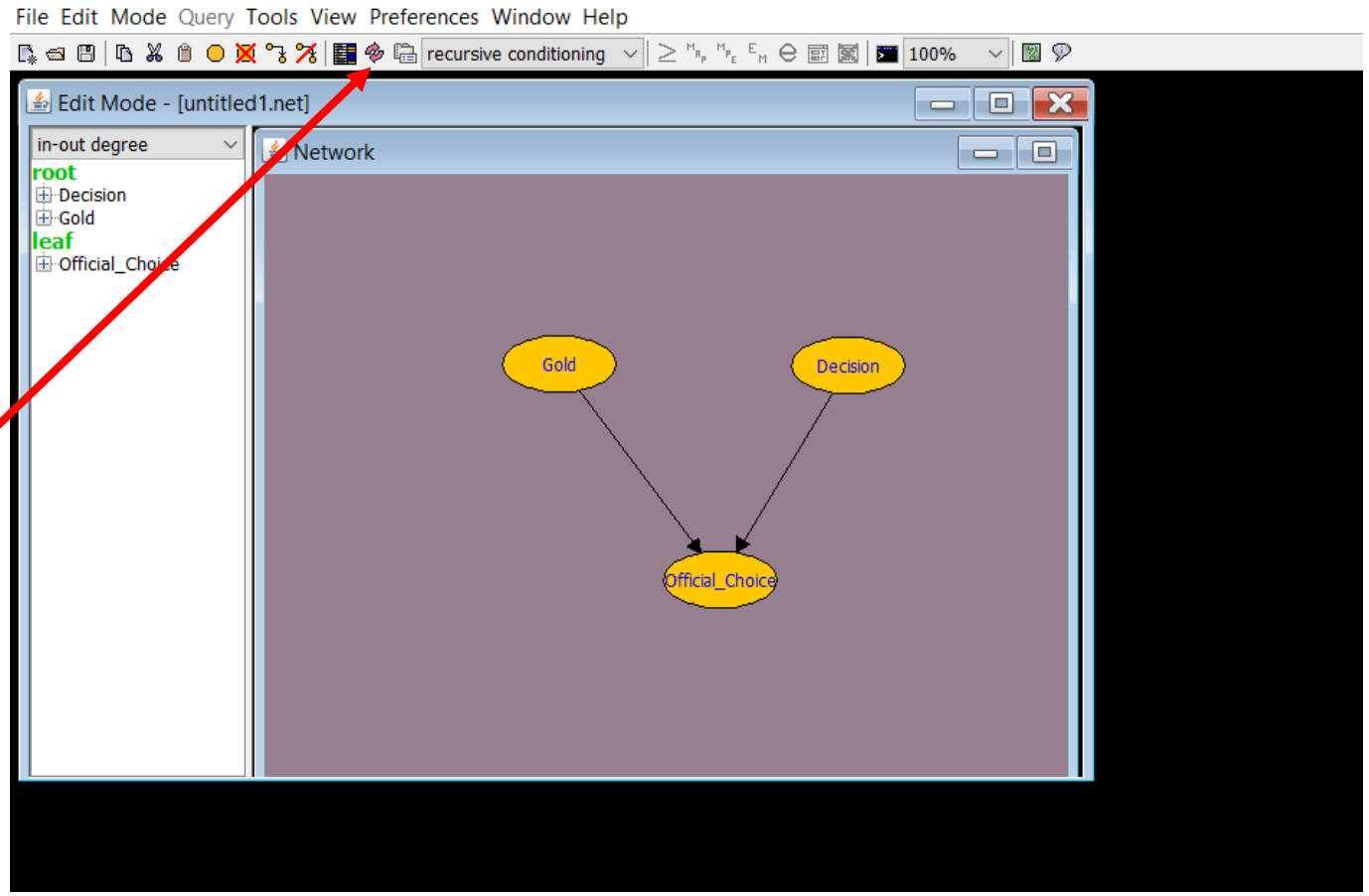
You can choose to paste only the nodes with Edit -> Paste Special.
In this case **only the CPTs of the root nodes are retained**



Samlam Introduction

- Now you can ask some query to the network:

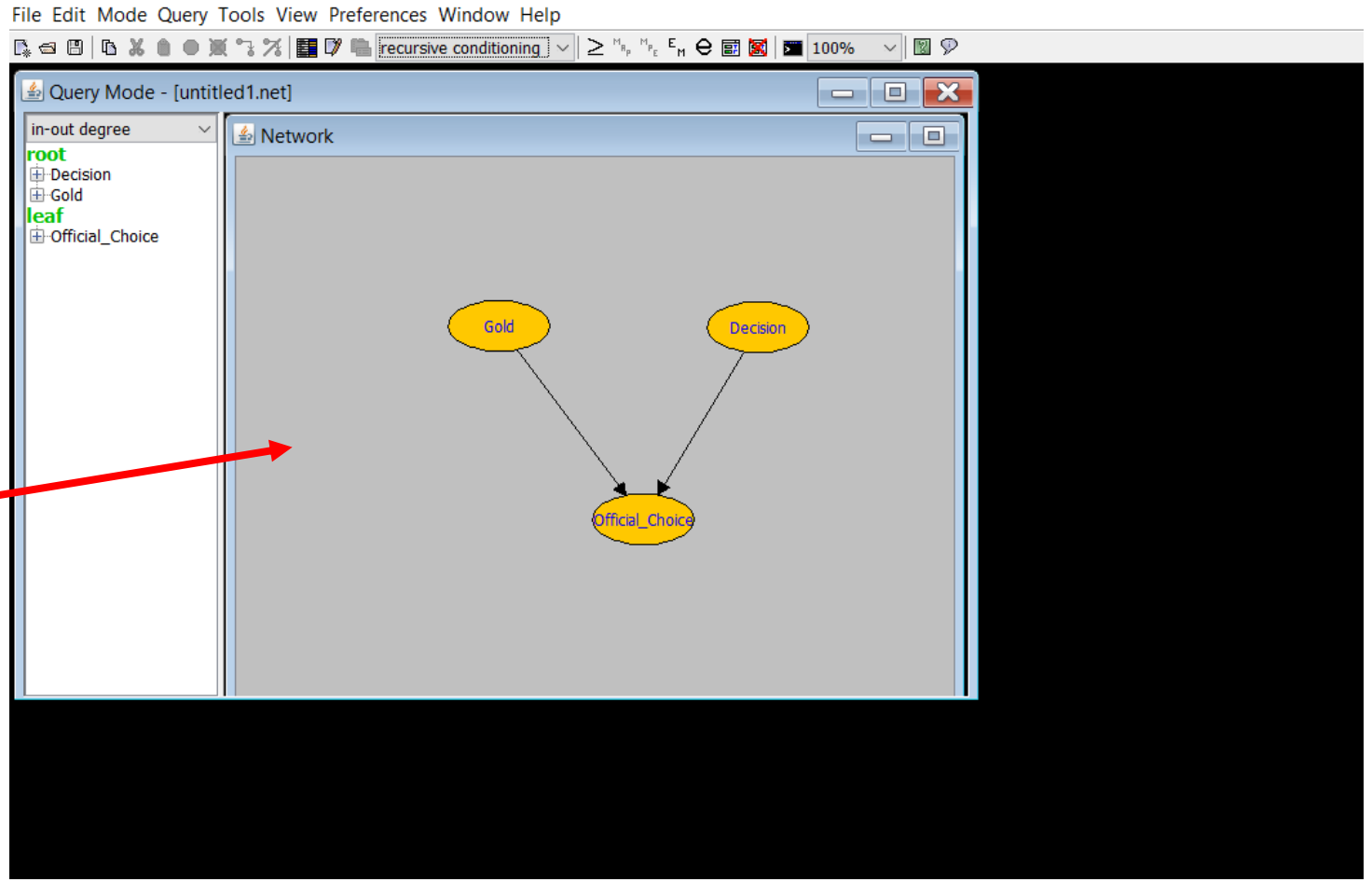
Clicking on this button you can enter in the query mode



Samlam Introduction

- Now you can ask some query to the network:

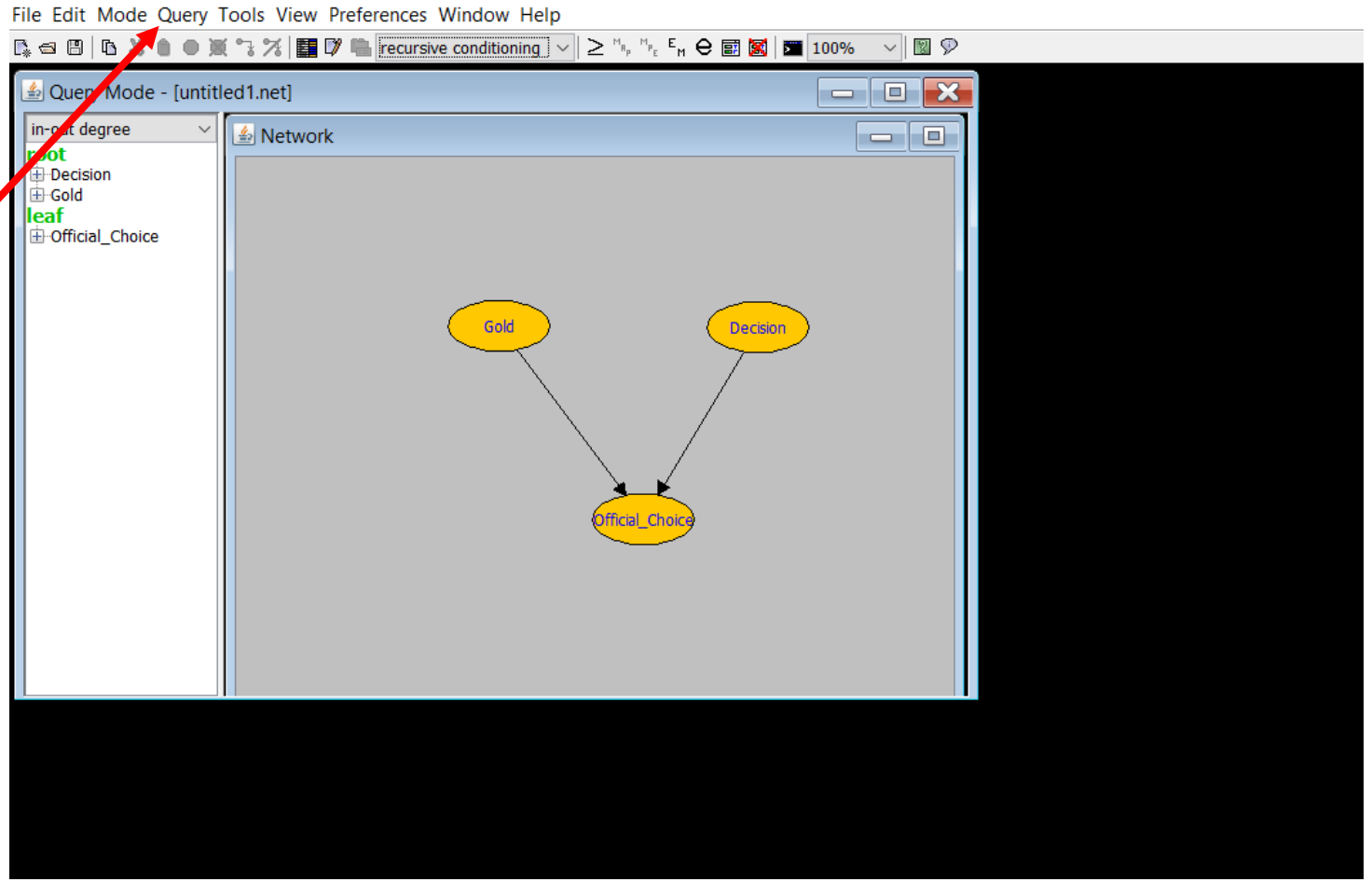
The query mode has a different layout



Samlam Introduction

- Now you can ask some query to the network:

In this mode you can see the posterior probabilities of every variable. To see it you can click on Query -> Show monitors -> Show All.



Samlam Introduction

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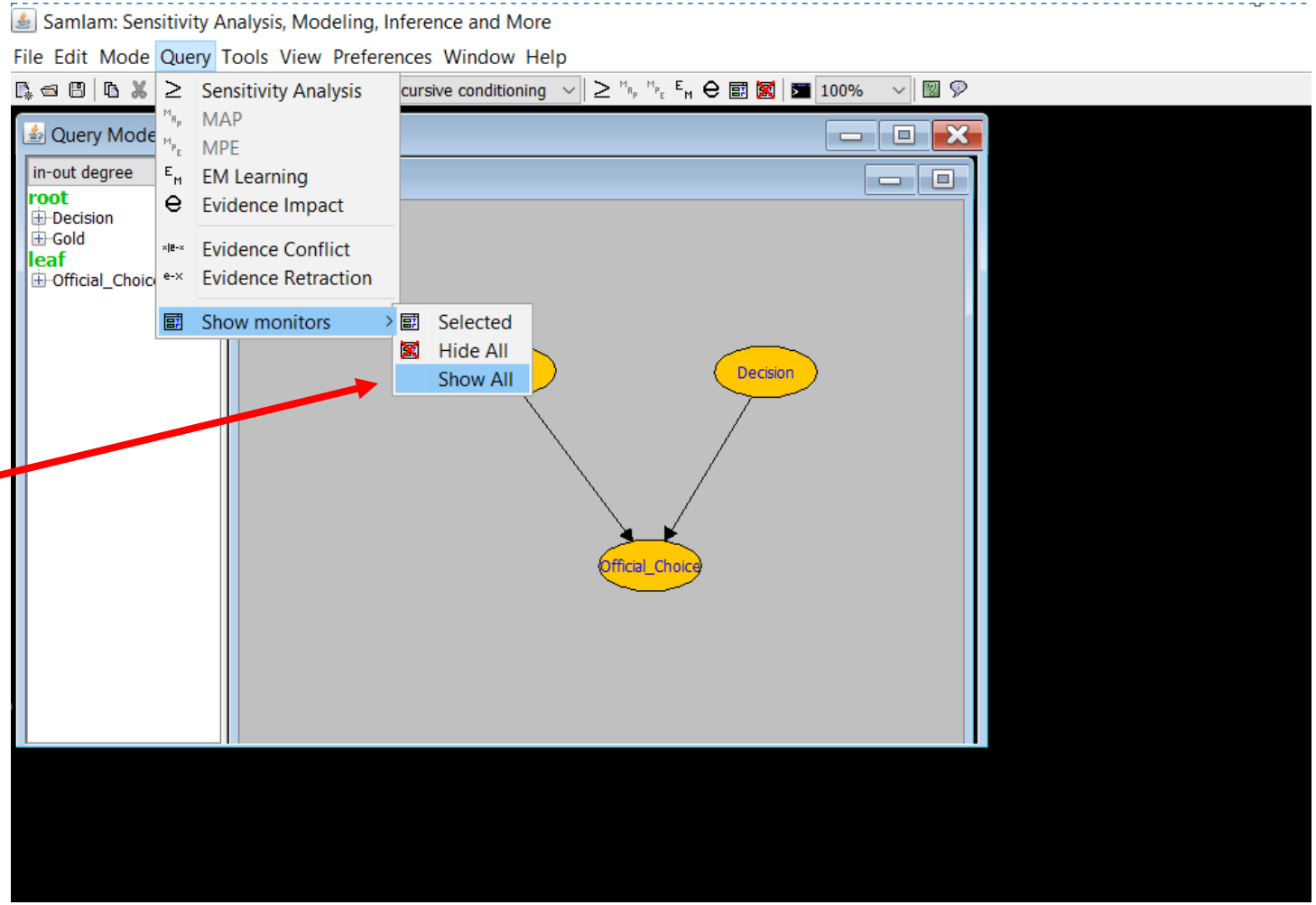
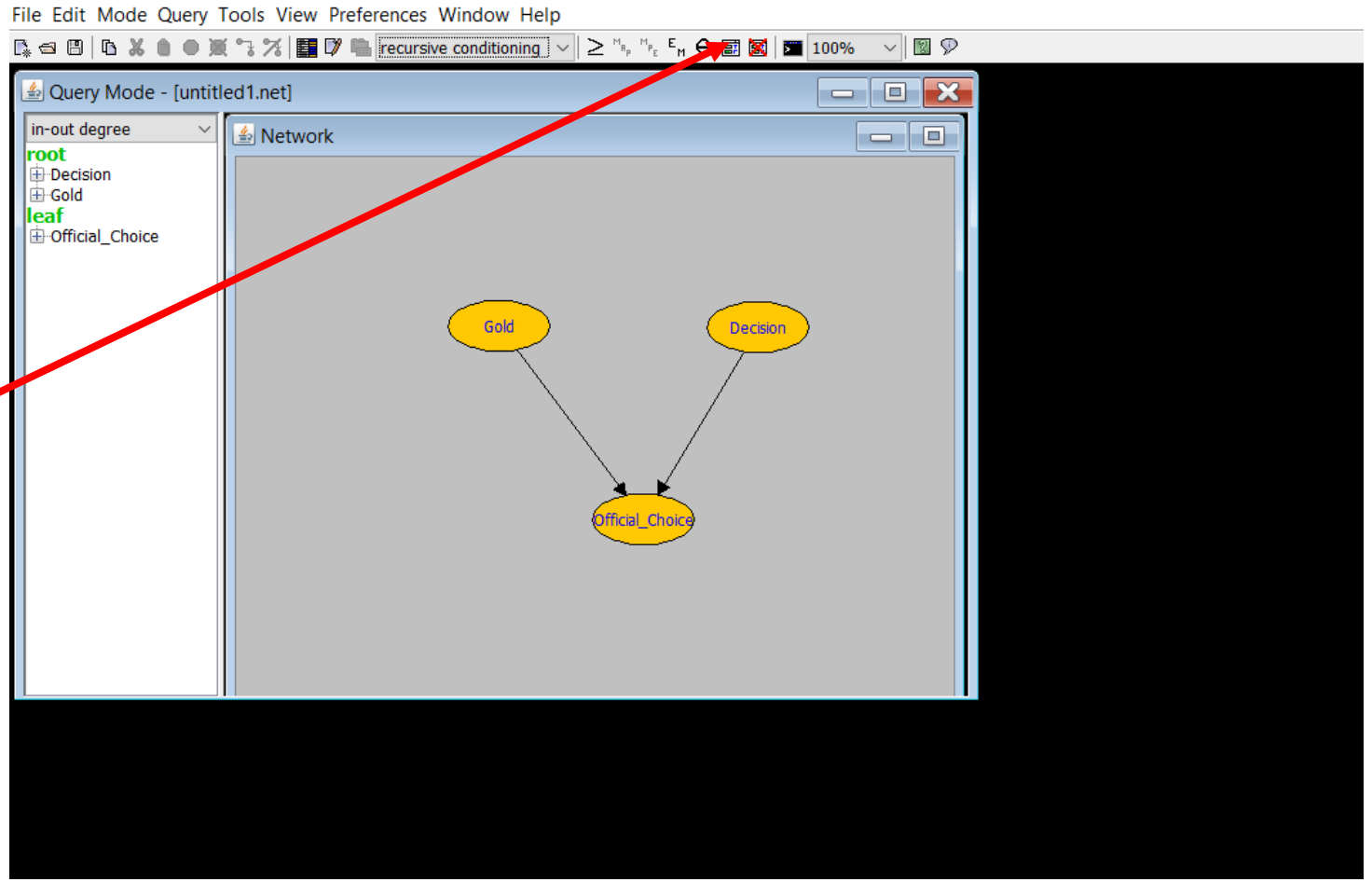


Samlam Introduction

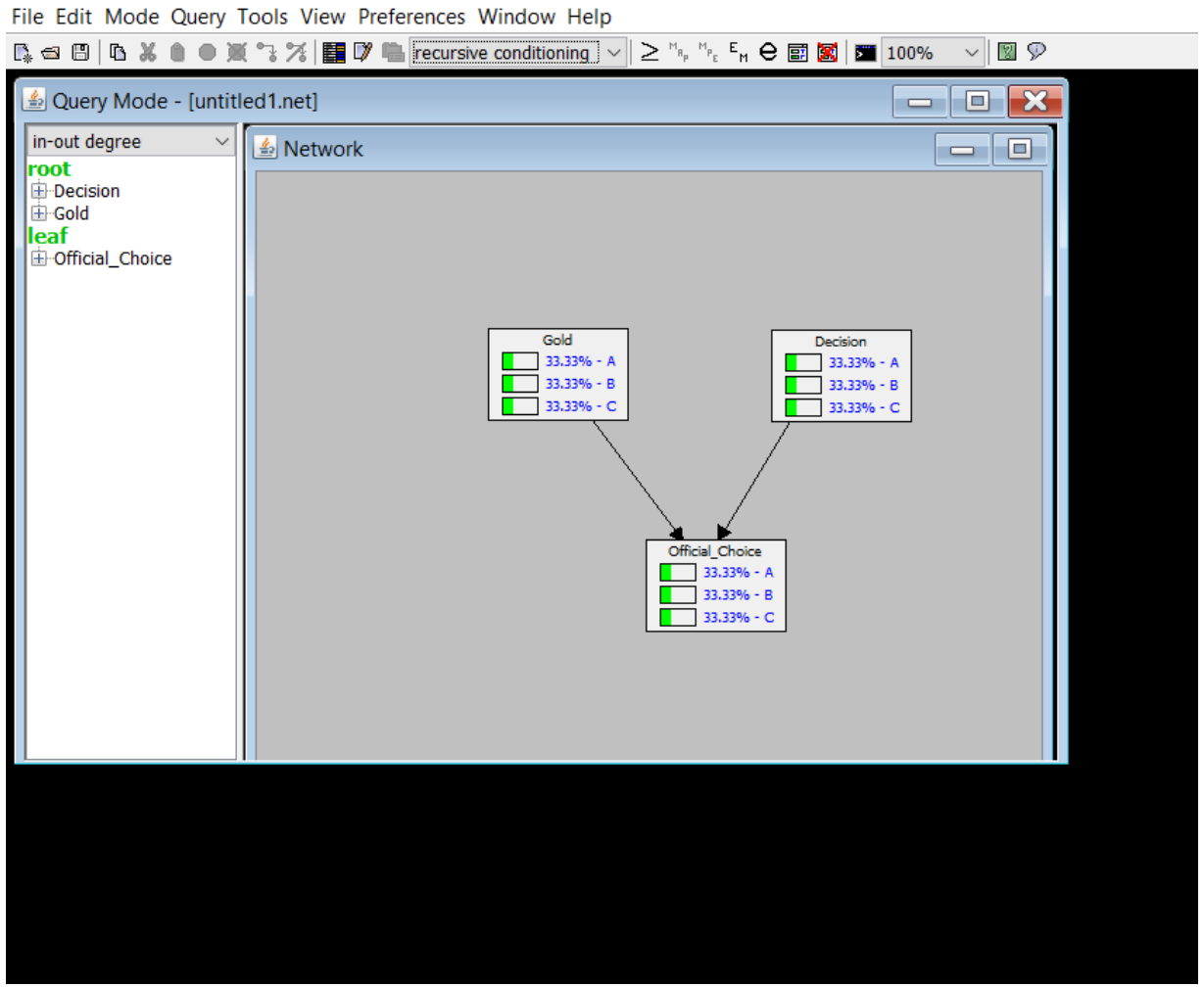
- Now you can ask some query to the network:

You can see all the monitors also clicking directly on this button



Samlam Introduction

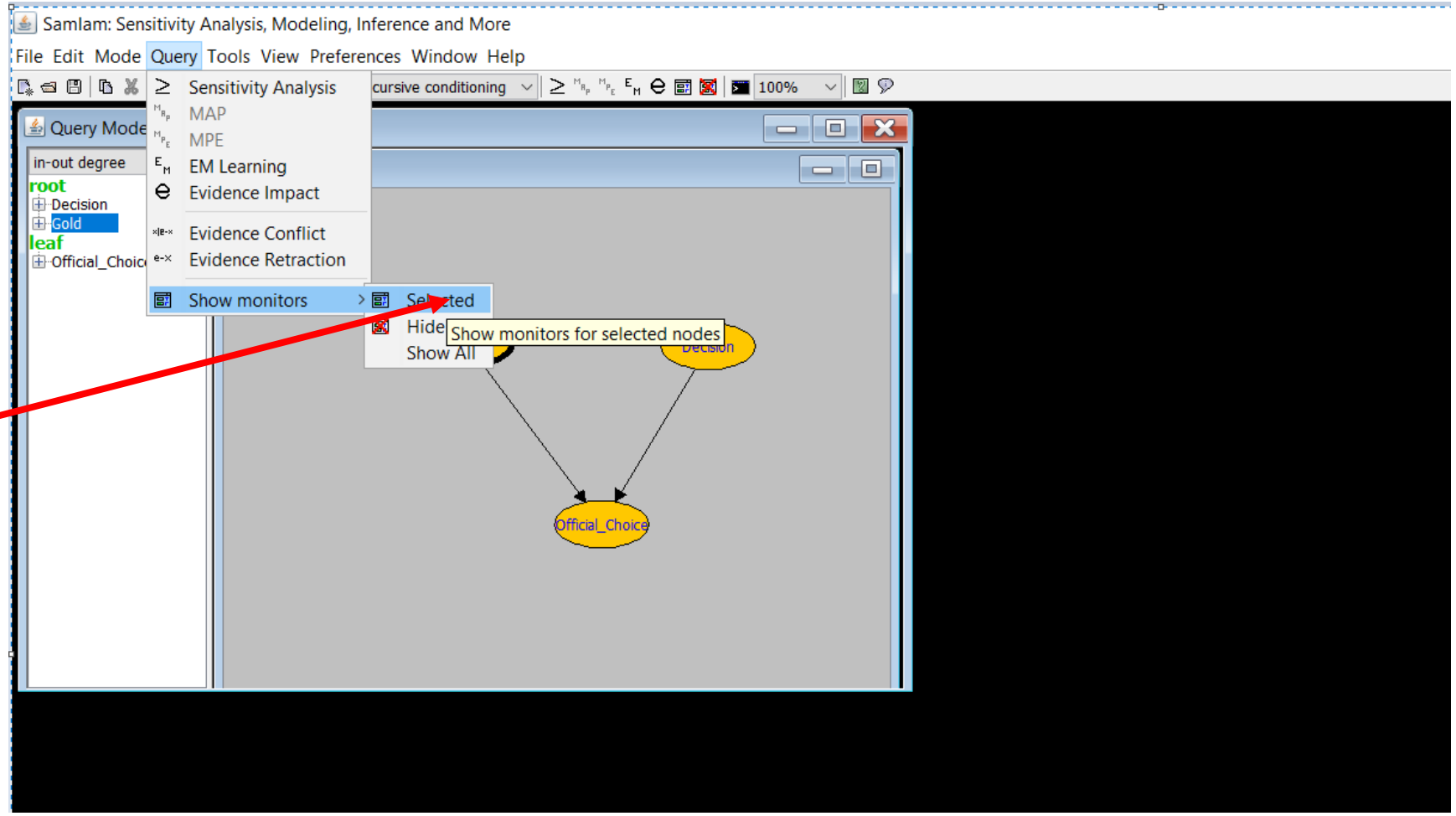
- Now you can ask some query to the network:



Samlam Introduction

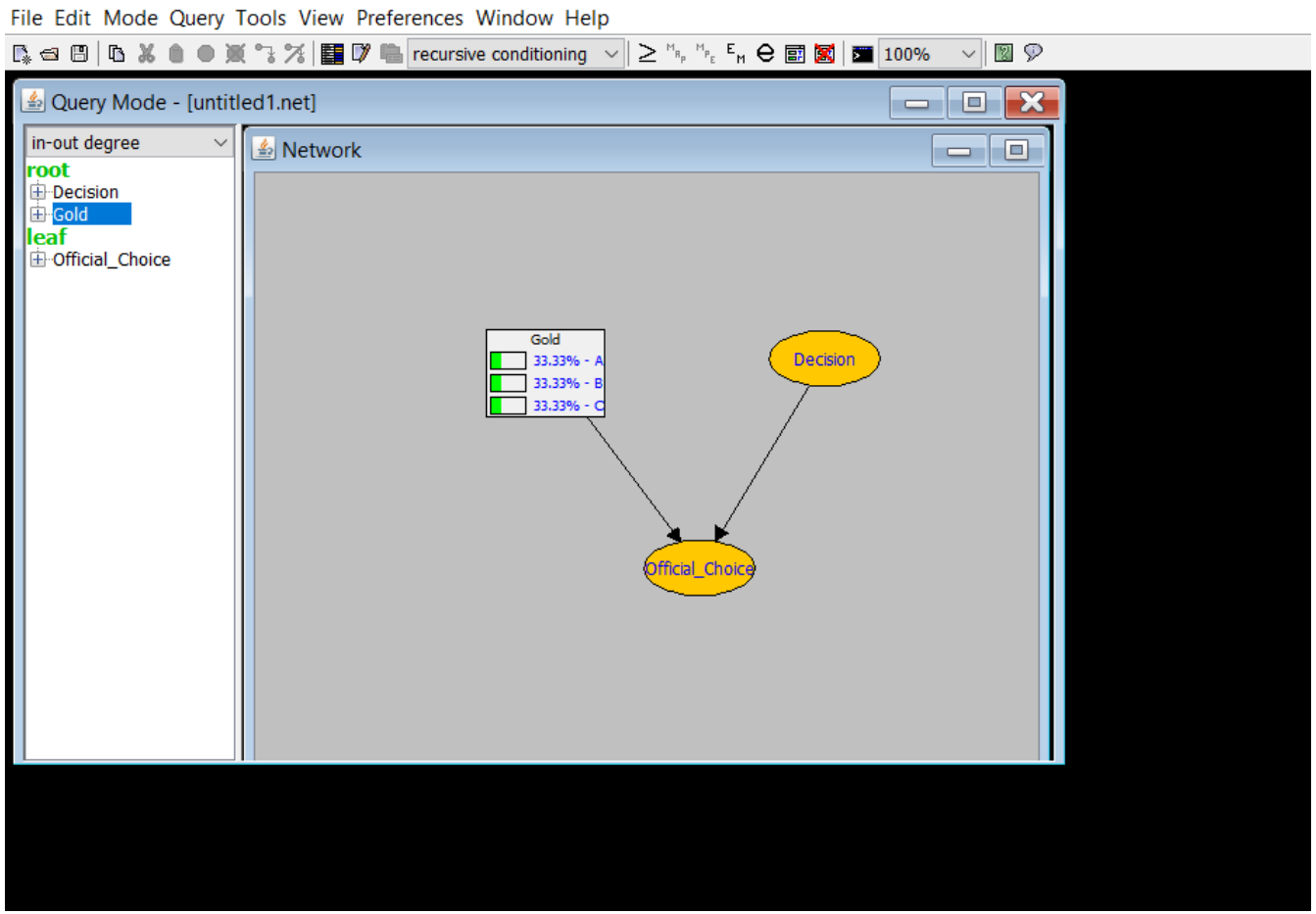
- Now you can ask some query to the network:

You can also choose to see posterior probabilities of only some selected variables. To make this you must select the nodes representing the variables(clicking on them or clicking and drag the mouse to select multiple ones) and the click on «Selected»



Samlam Introduction

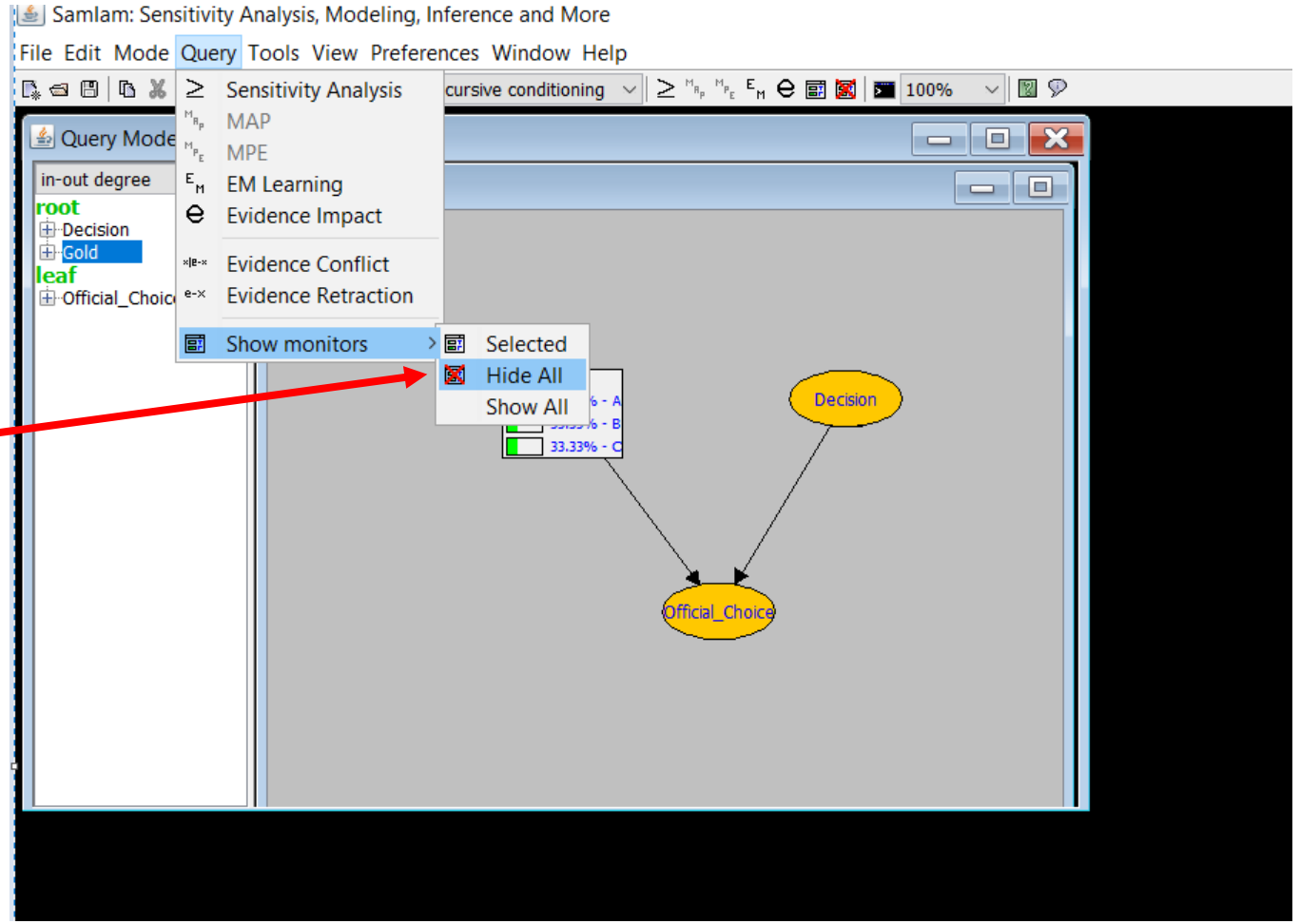
- Now you can ask some query to the network:



Samlam Introduction

- Now you can ask some query to the network:

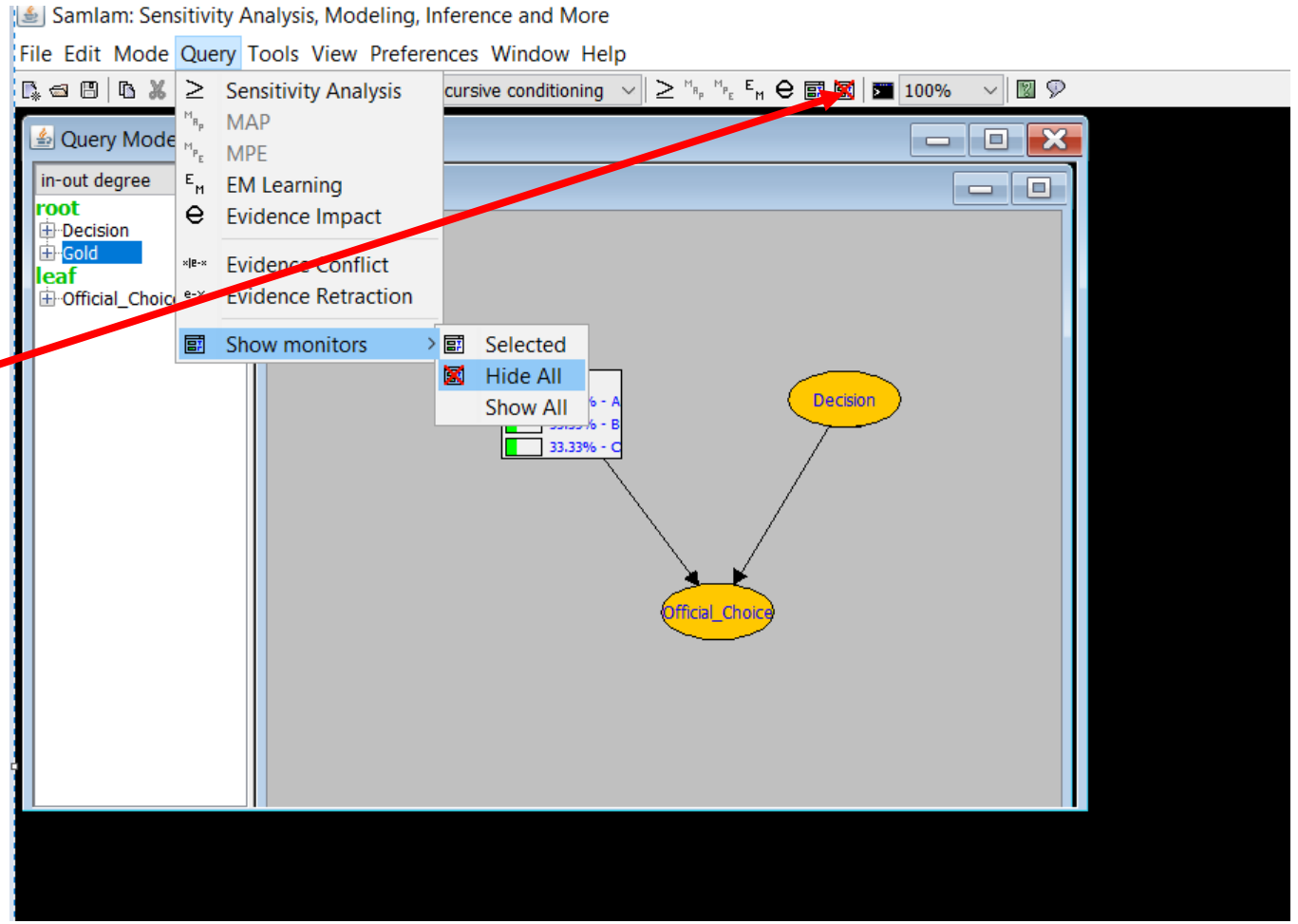
You can also choose to hide all the monitors.



Samlam Introduction

- Now you can ask some query to the network:

Also clicking this button

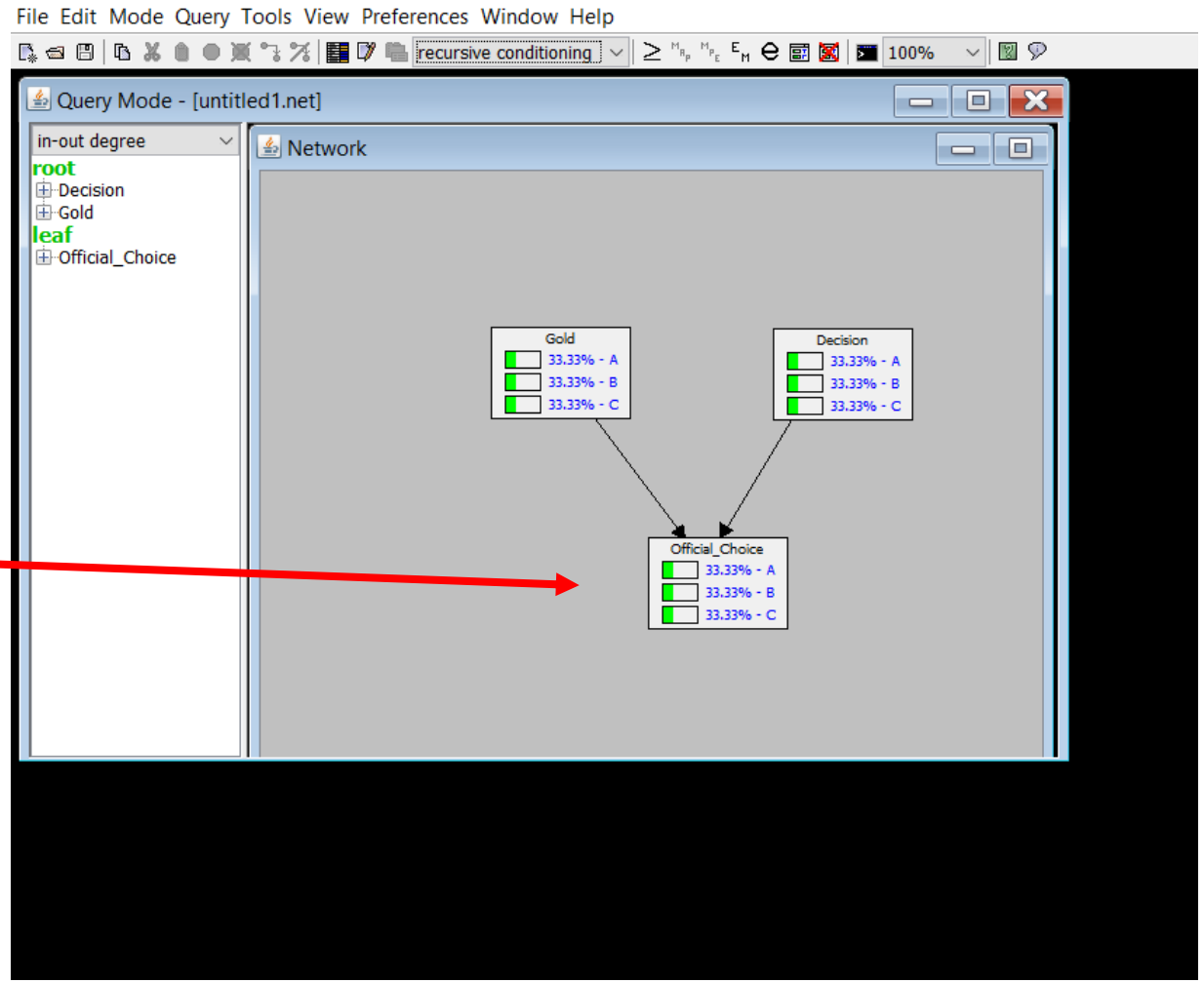


Samlam Introduction

- Now you can ask some query to the network:

You can put some evidence (fix a variable to take some value) in the network clicking in the monitor and then on the value that the variable must assume.

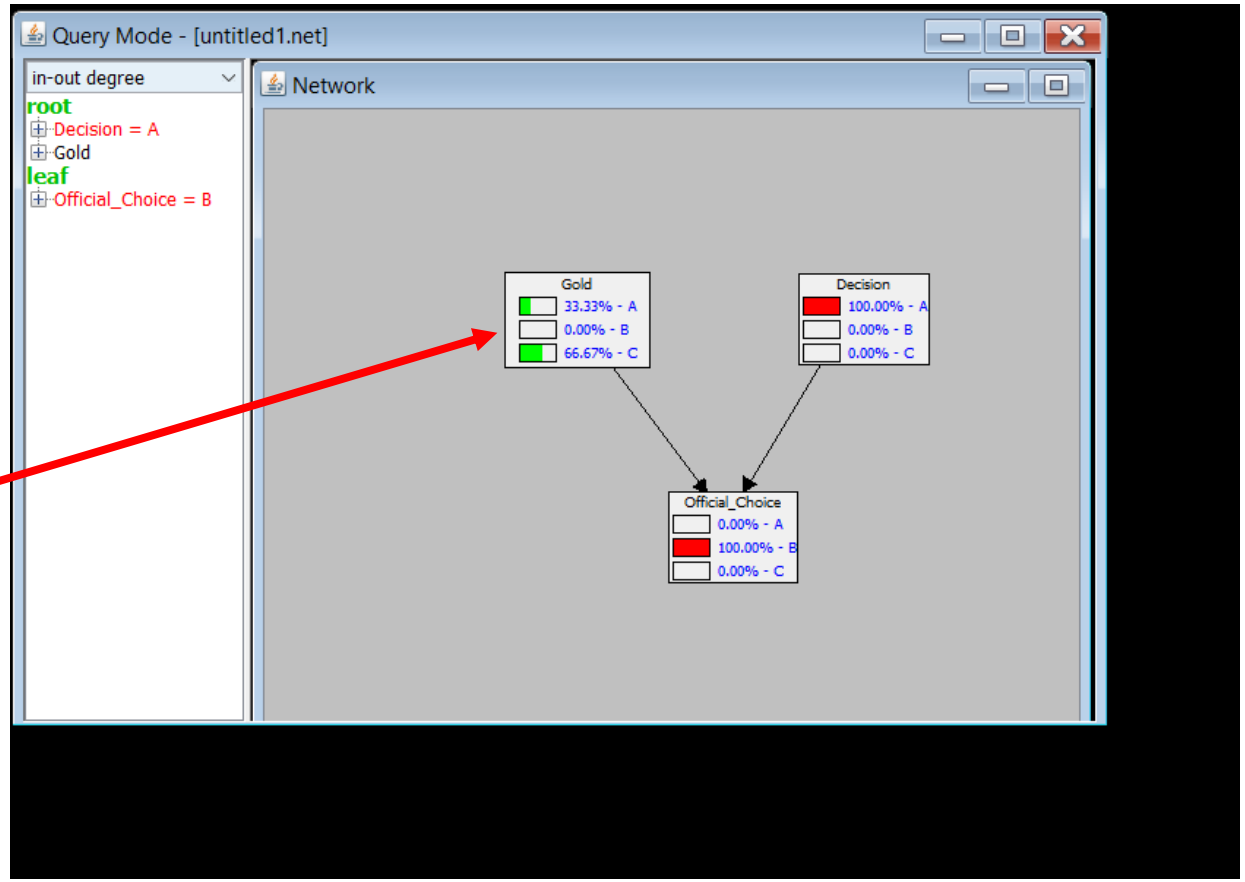
The network updates itself immedeatly.



Samlam Introduction

- Now you can ask some query to the network:

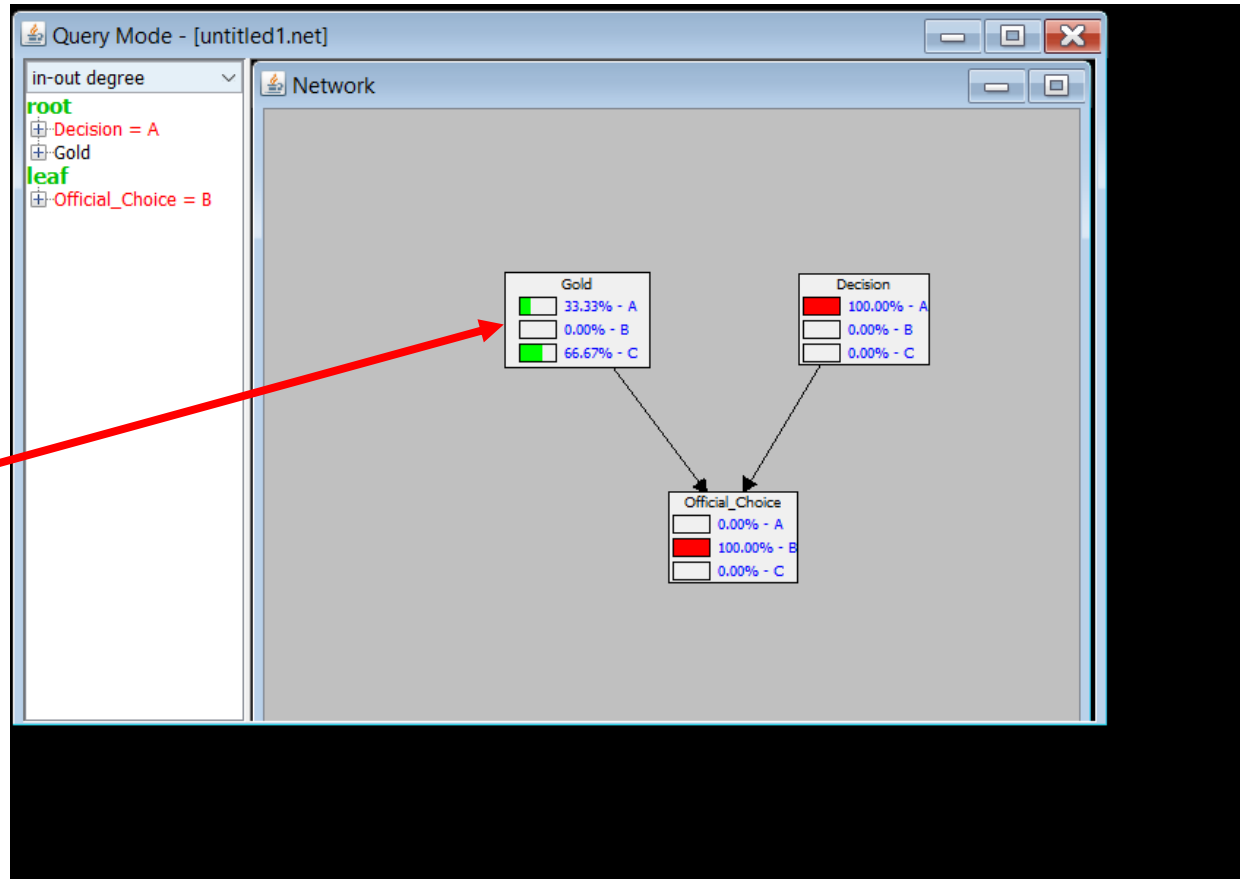
Now you can see in this monitor , for example, the answer of the query «If my initial decision was to choose the door A and the Official chose to open the door B, should I change my choice?»



Samlam Introduction

- Now you can ask some query to the network:

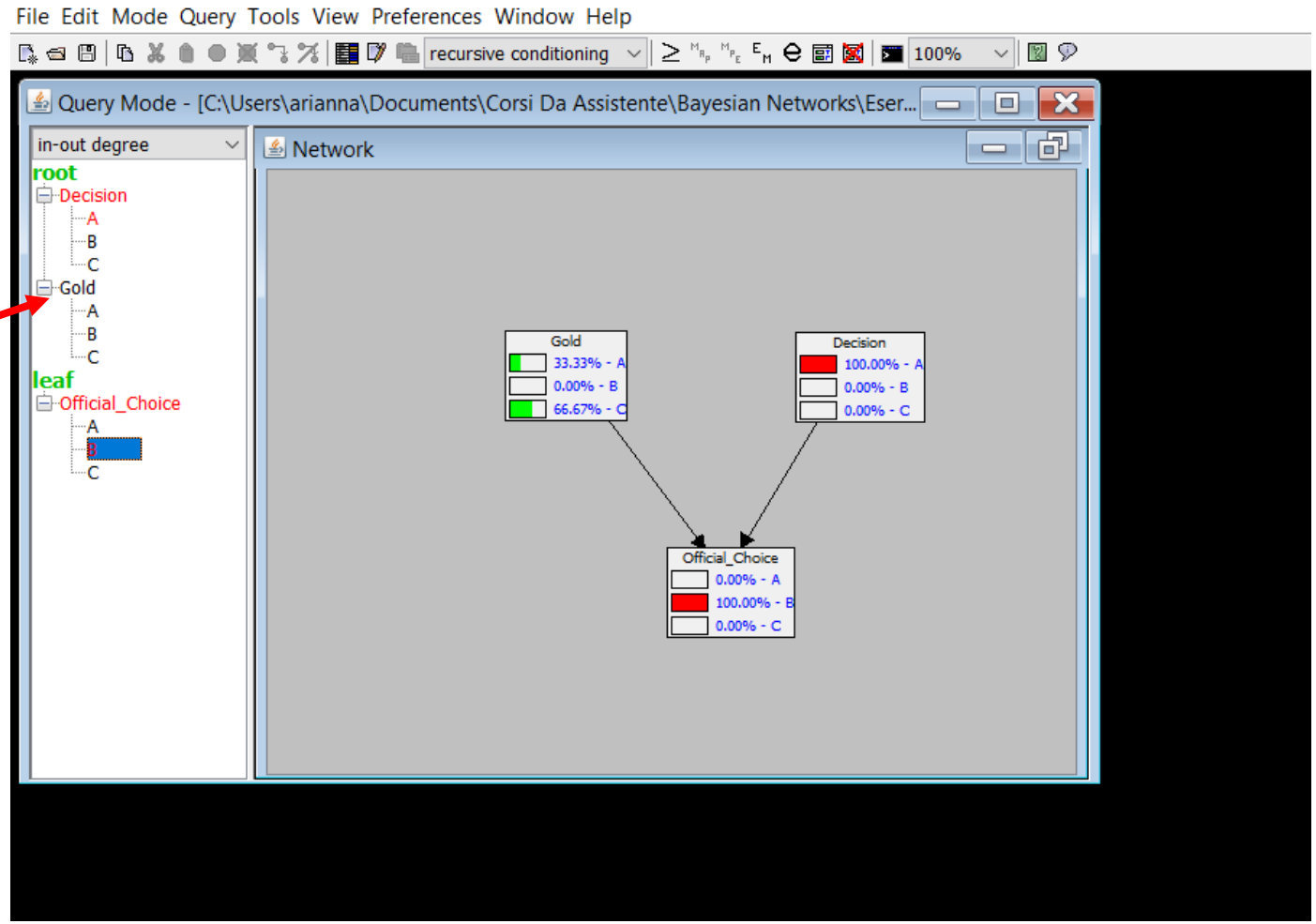
Yes!
Because the probabilitiy (given the evidences in the network) of finding the prize behind the door C is double respect to the probability to find it behind the initial door A!



Samlam Introduction

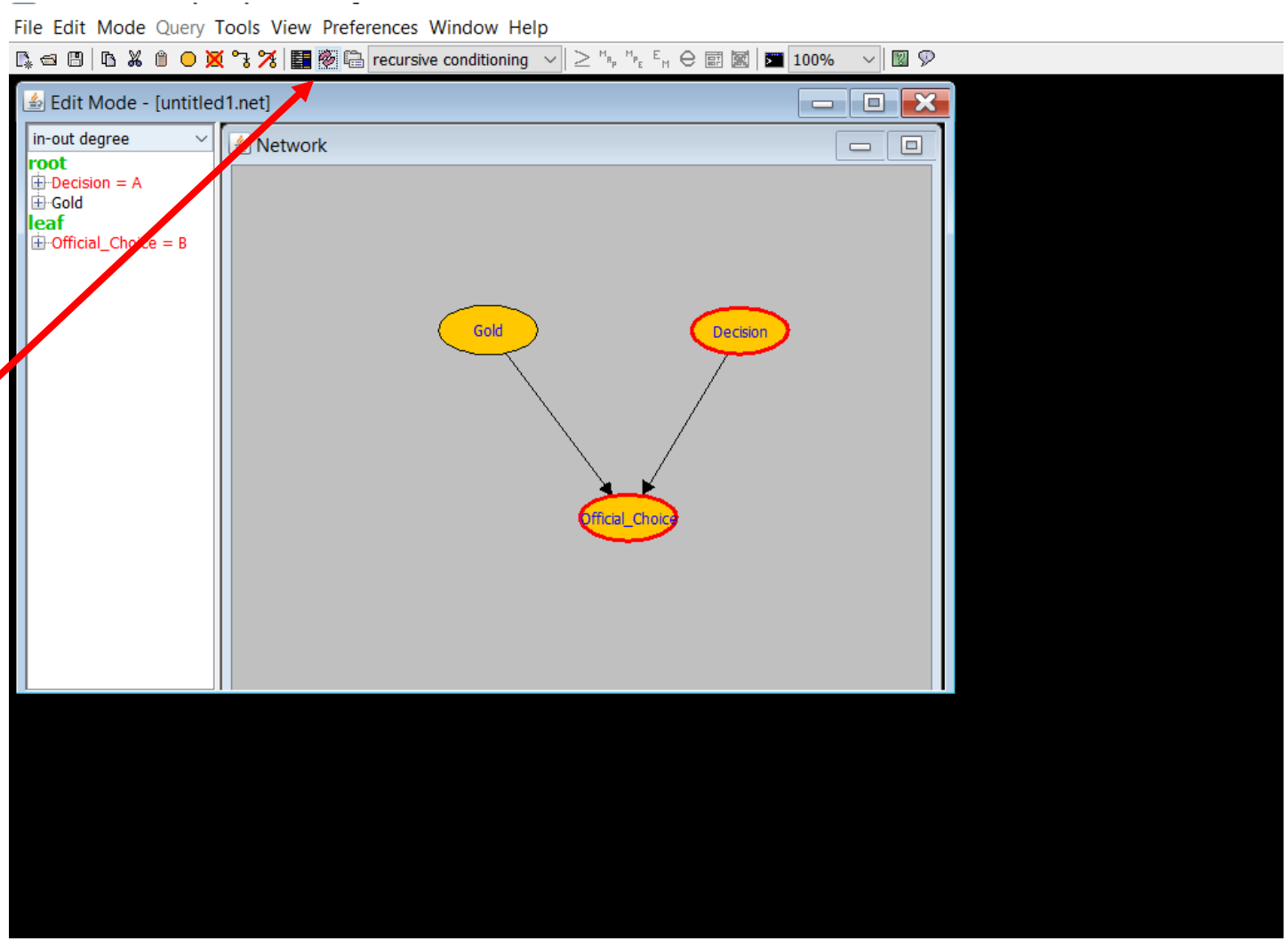
- Now you can ask some query to the network:

You can fix the evidences also in the left panel double-clicking on the selected state of the variable



Samlam Introduction

Double-clicking on the same button you can return in the initial mode and you can see on which variables you have insert some evidence. It's the only mode in which you can modify your network.



Samlam Introduction

To delete the evidencies you must return in the query mode and double-clicking on the monitor with the evidence.