

SamIam

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.
- Samlam **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

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


where the product runs over all the nodes

SamIam 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:



The screenshot shows the SamIam website interface. At the top, the 'SamIam' logo is displayed in yellow. Below it, a navigation bar contains links: Reasoning Group, Download, Online Help, Report a Bug, Credits, and Contact. A secondary bar reads 'SENSITIVITY ANALYSIS, MODELING, INFERENCE AND MORE'. On the left, a vertical menu lists various tools and features: BatchTool, Code Bandit, Editing Models, EM Learning, File Formats, Inference, MAP, MPE, Sensitivity Analysis, Time-Space Tradeoffs, and Timing MAP. The main content area features three tabs: 'SamIam Release' (selected), 'BatchTool', and 'SamIam Classic'. Below the 'SamIam Release' tab, the heading 'Download SamIam Release' is shown. A list of instructions follows: 'Before downloading SamIam Release, please, tell us about yourself.' and 'All fields are required.' Below these instructions are three input fields labeled 'Name:', 'Email:', and 'Institution:'. A 'Download' button is positioned below the 'Institution:' field. At the bottom of the page, a footer contains the text 'AR Group, UCLA' on the left and a series of links (Home, Screenshots, Sponsors, Suggestions, Videos, FAQ, Links) on the right. A dedication line reads 'Dedicated to the memory of J.D. Park'. The copyright notice at the very bottom states 'Copyright © 2004-2010, Automated Reasoning Group, University Of California, Los Angeles, All Rights Reserved.'

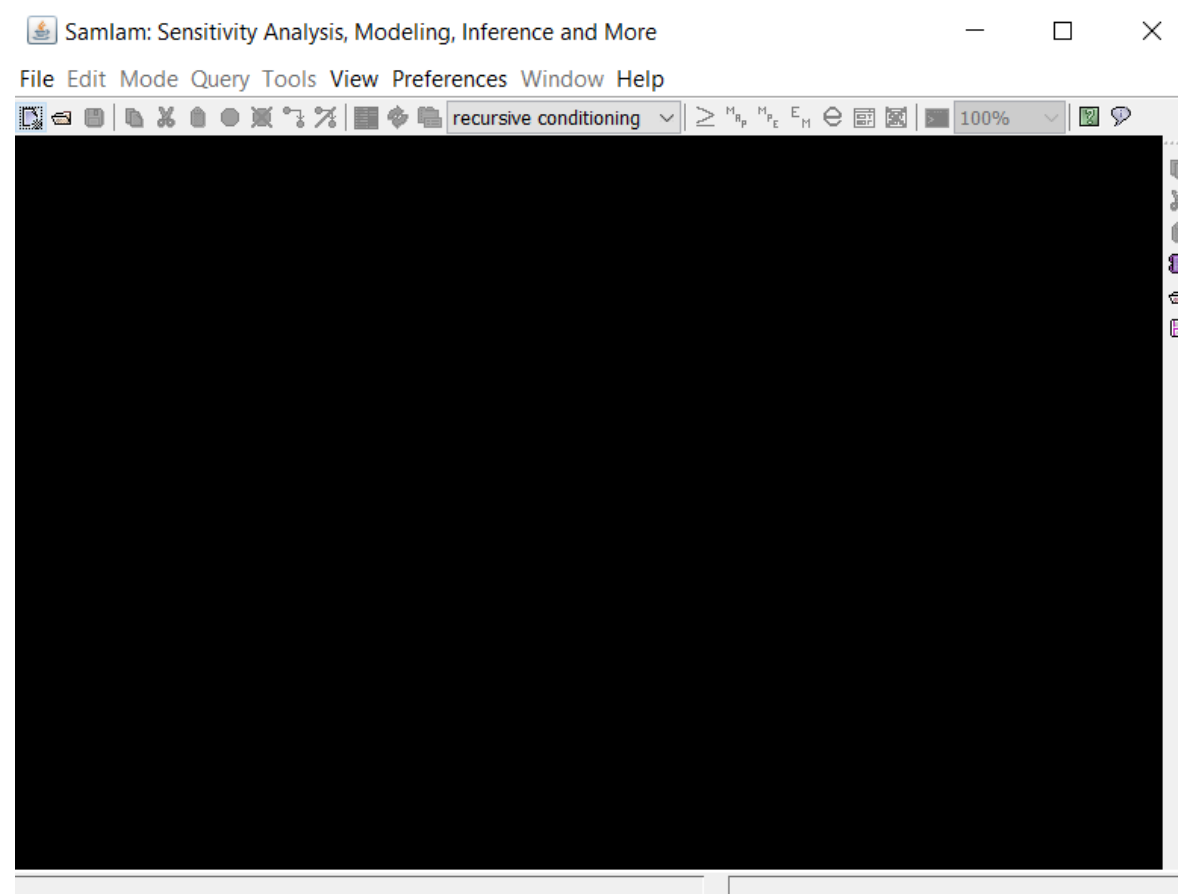
Samlam Introduction

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

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

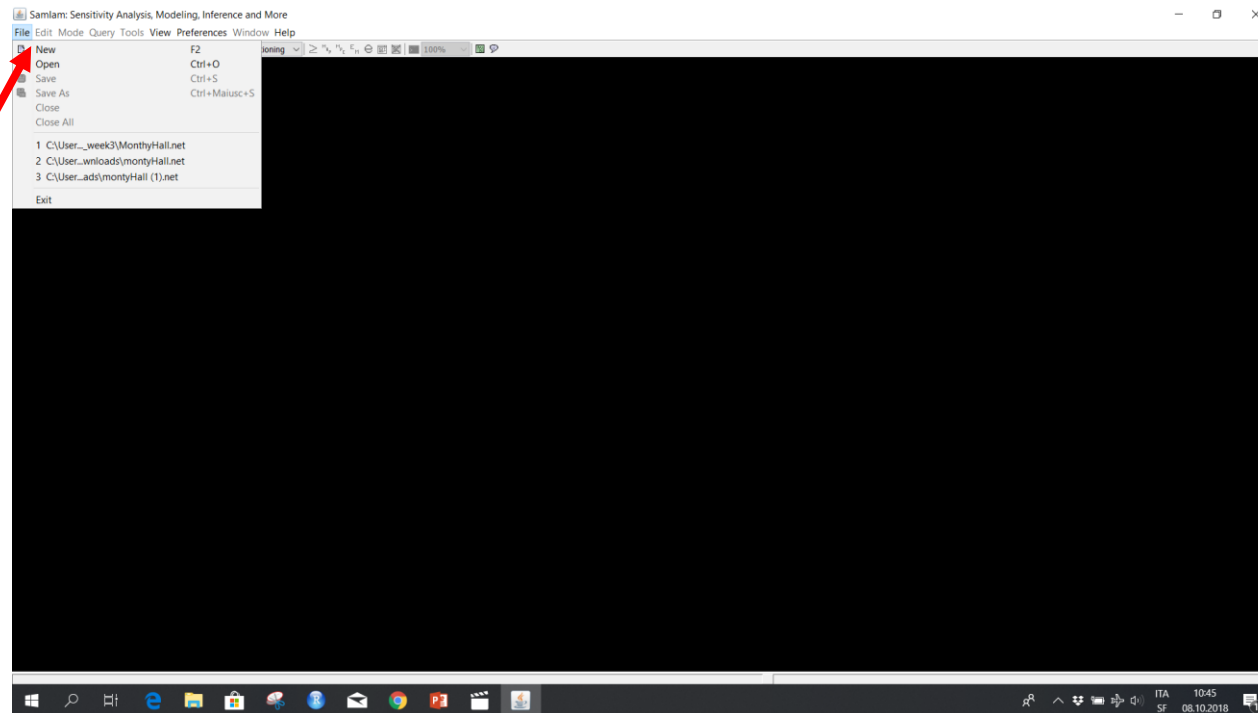
Samlam Introduction

- After the download you can open the program:



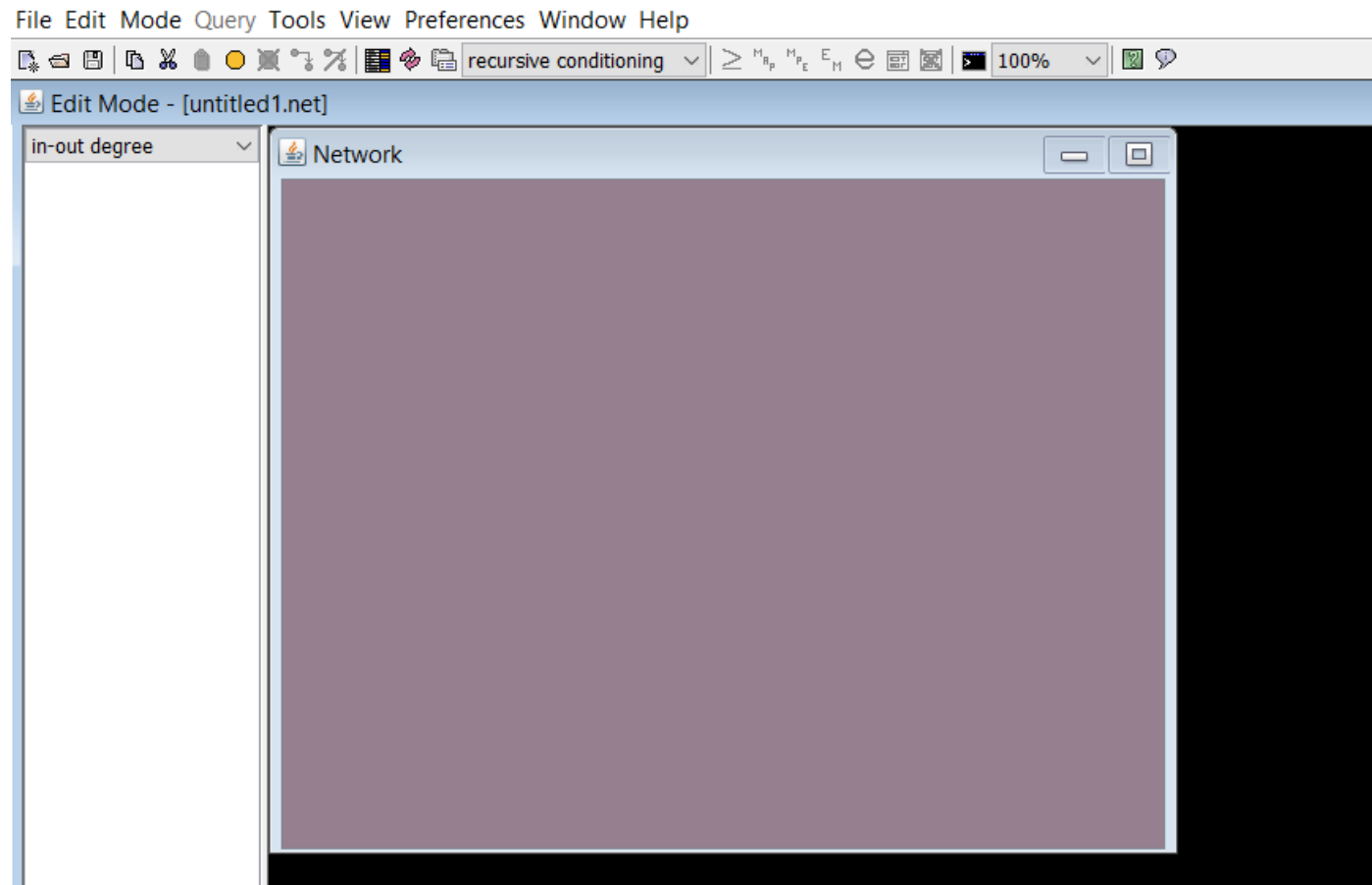
Samlam Introduction

- After the download you can open the program:



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

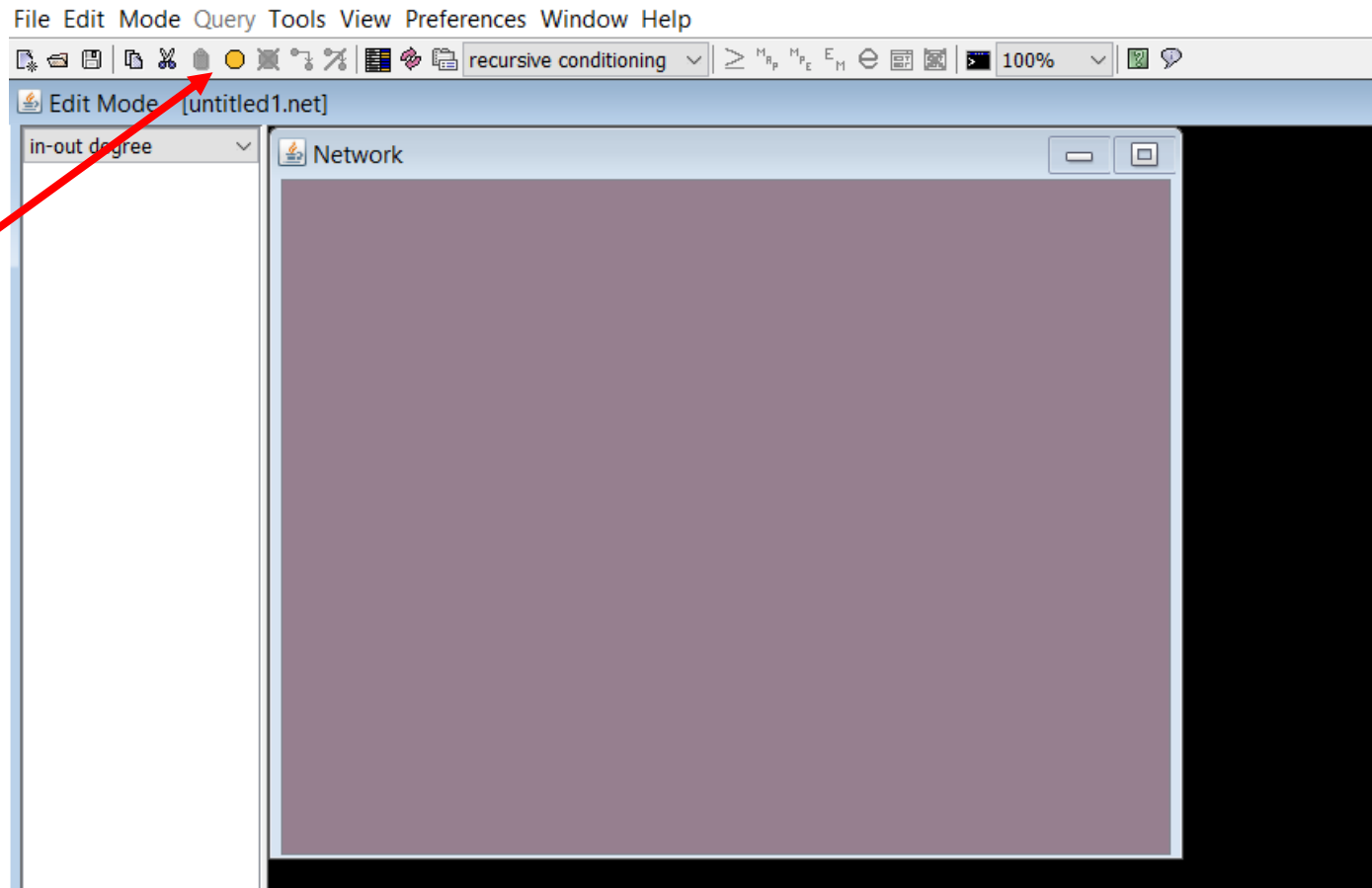
Samlam Introduction



Samlam Introduction

- Now you can start to create your network!

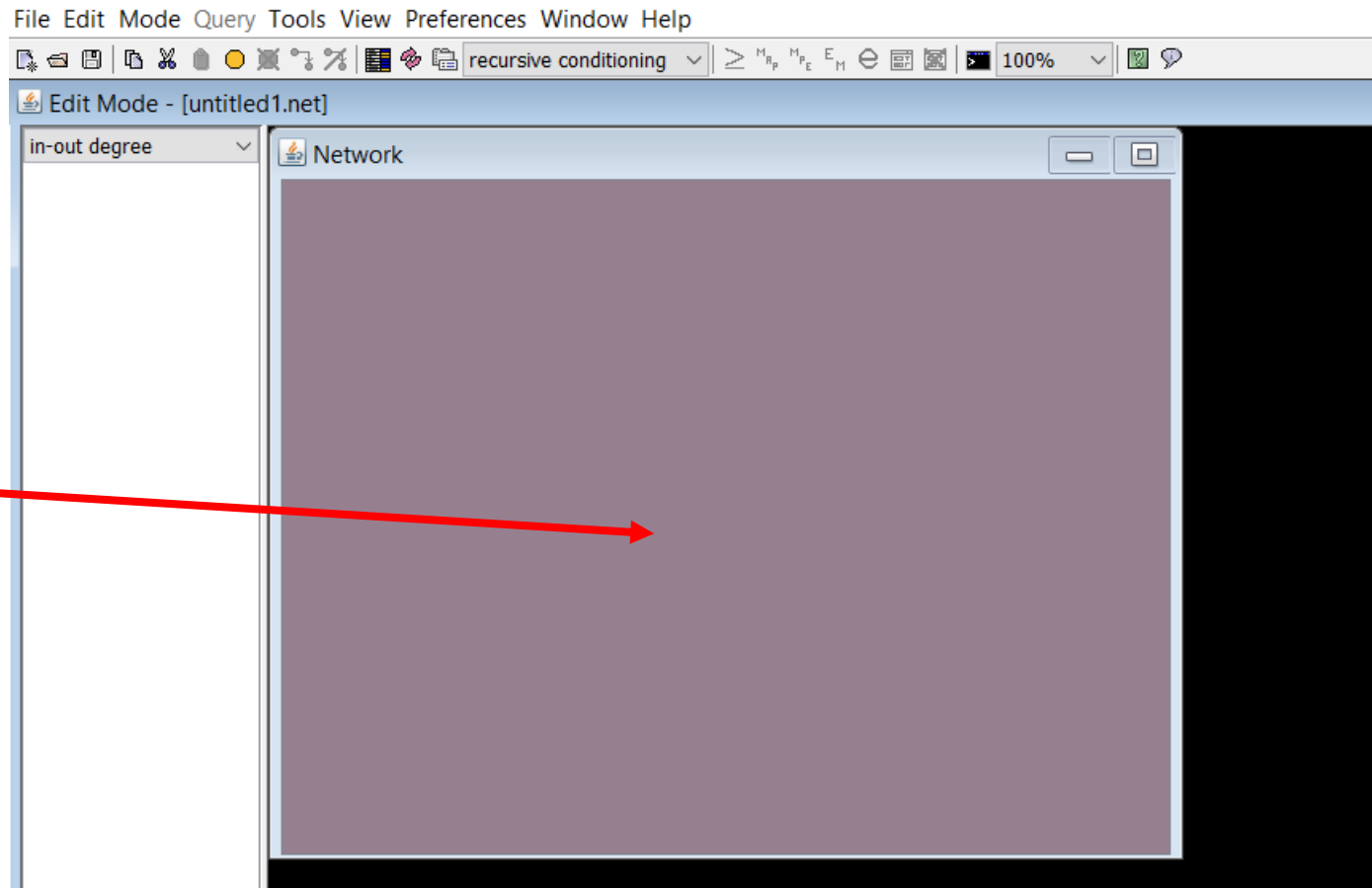
Clicking here
you can insert
the nodes of
your network



Samlam Introduction

- Now you can start to create your network!

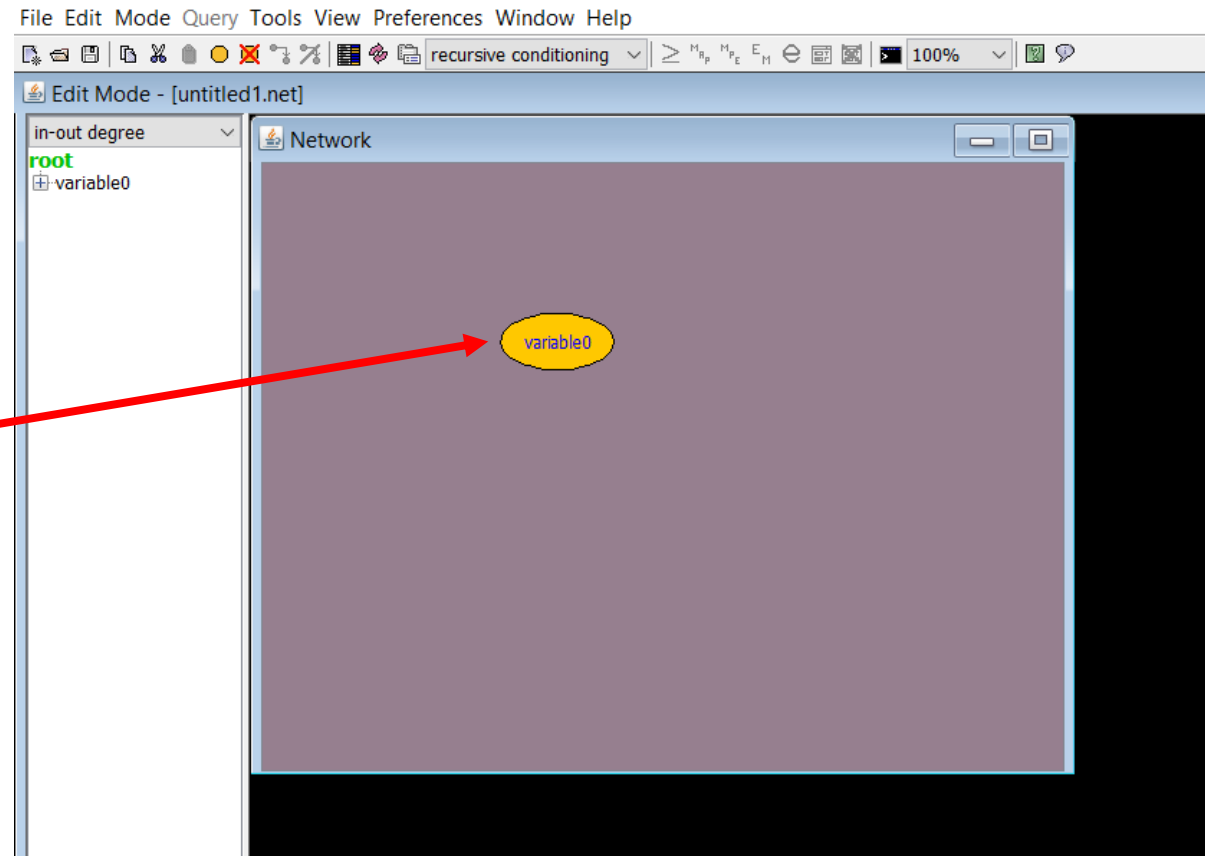
After clicking
you must
choose the
location of the
node



Samlam Introduction

- Now you can start to create your network!

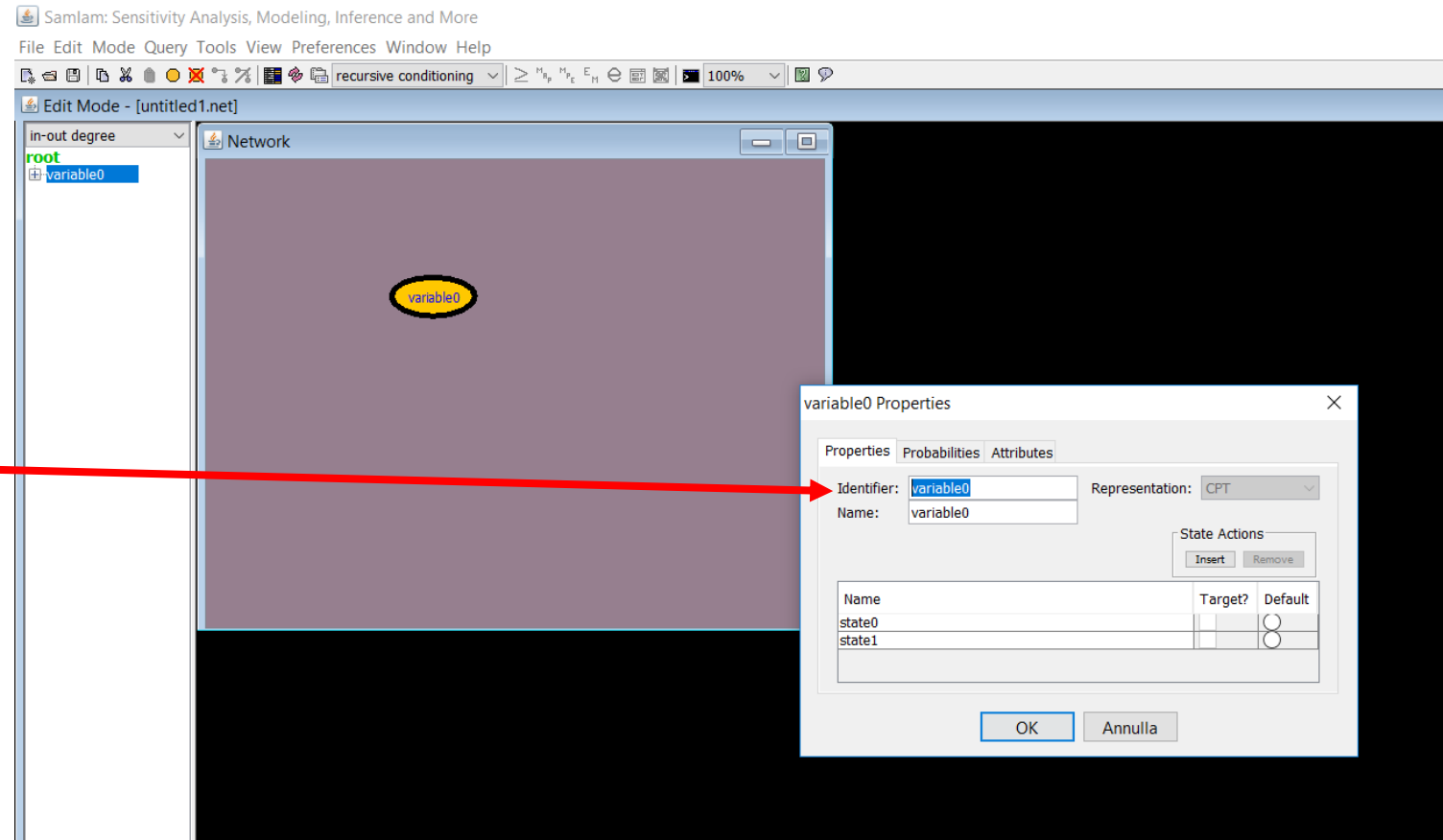
Now you can
rename the node
double clicking on it
(avoiding spaces
between letters or
words)



Samlam Introduction

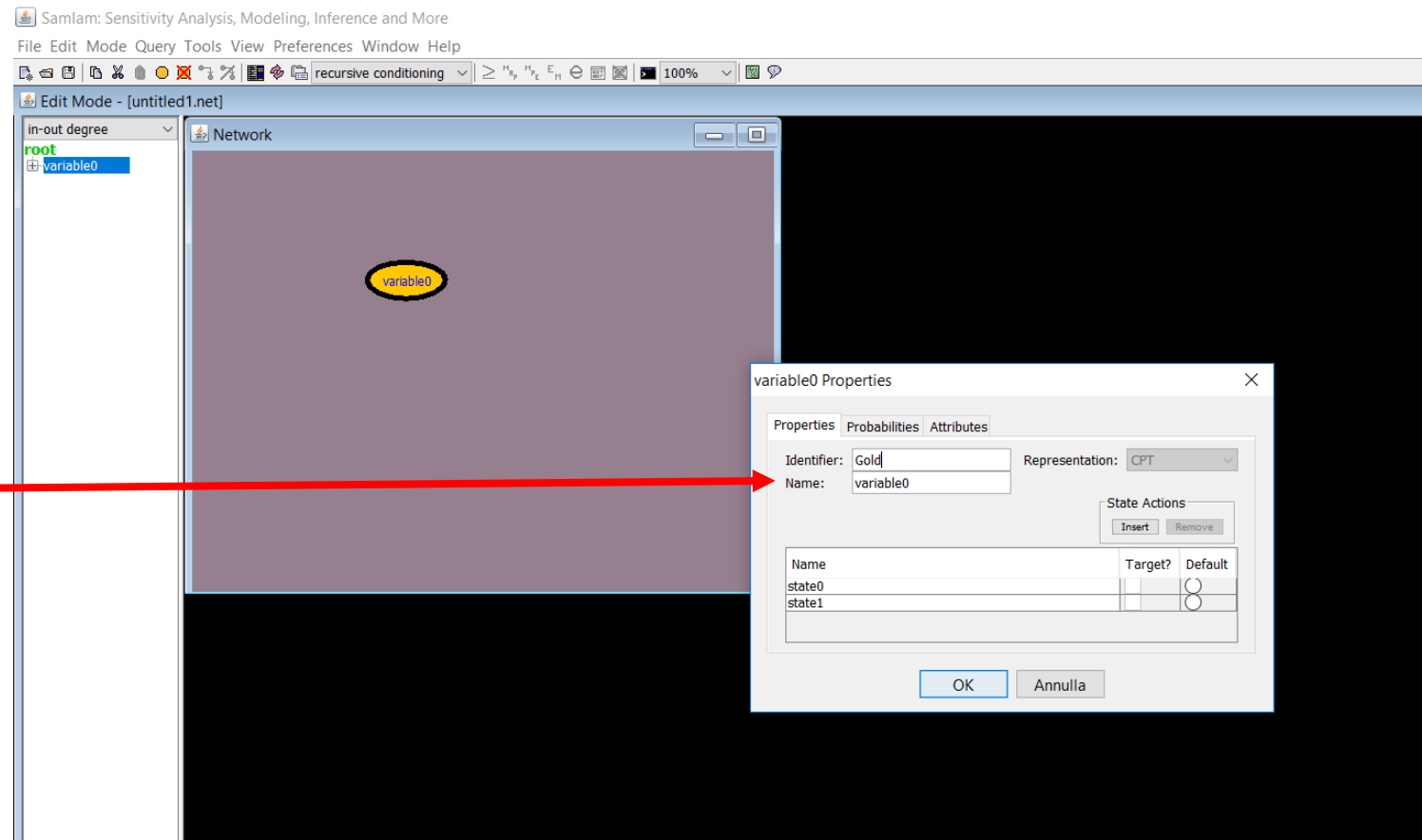
- Now you can start to create your network!

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



Samlam Introduction

- Now you can start to create your network!

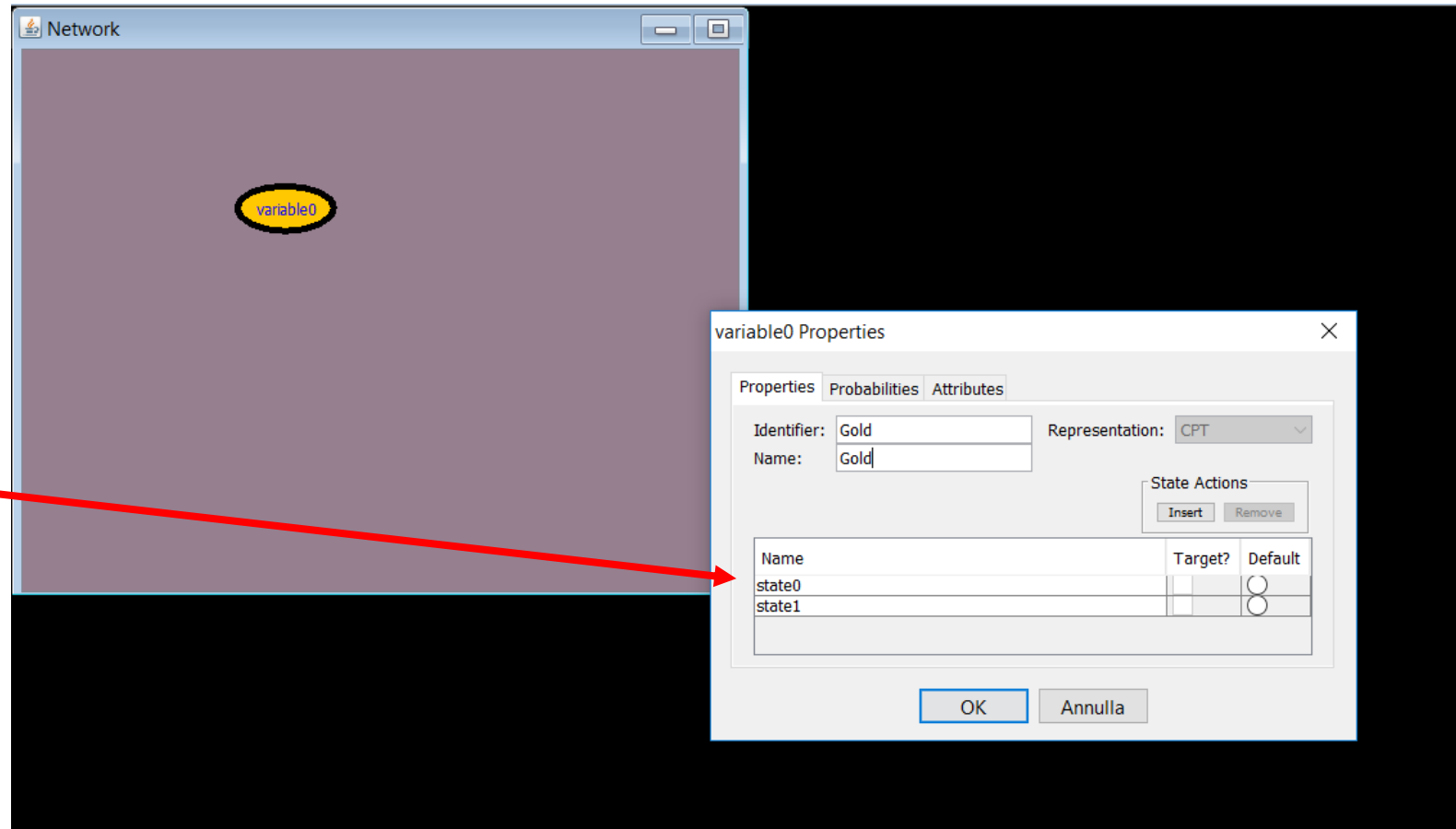


You can choose the name (it can be equal or different to the identifier)

Samlam Introduction

- Now you can start to create your network!

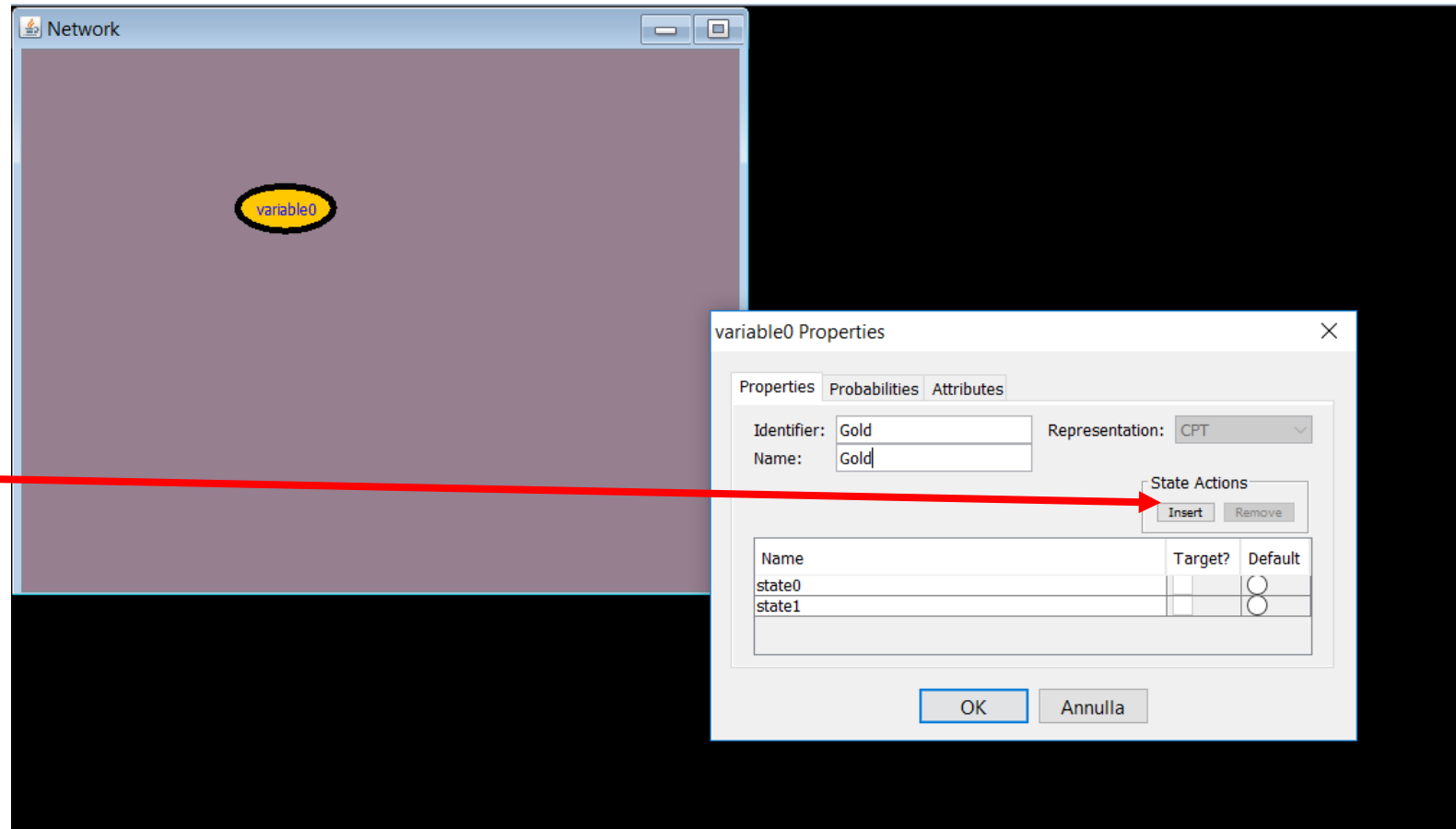
And the states of
the variable that
the node
represents



Samlam Introduction

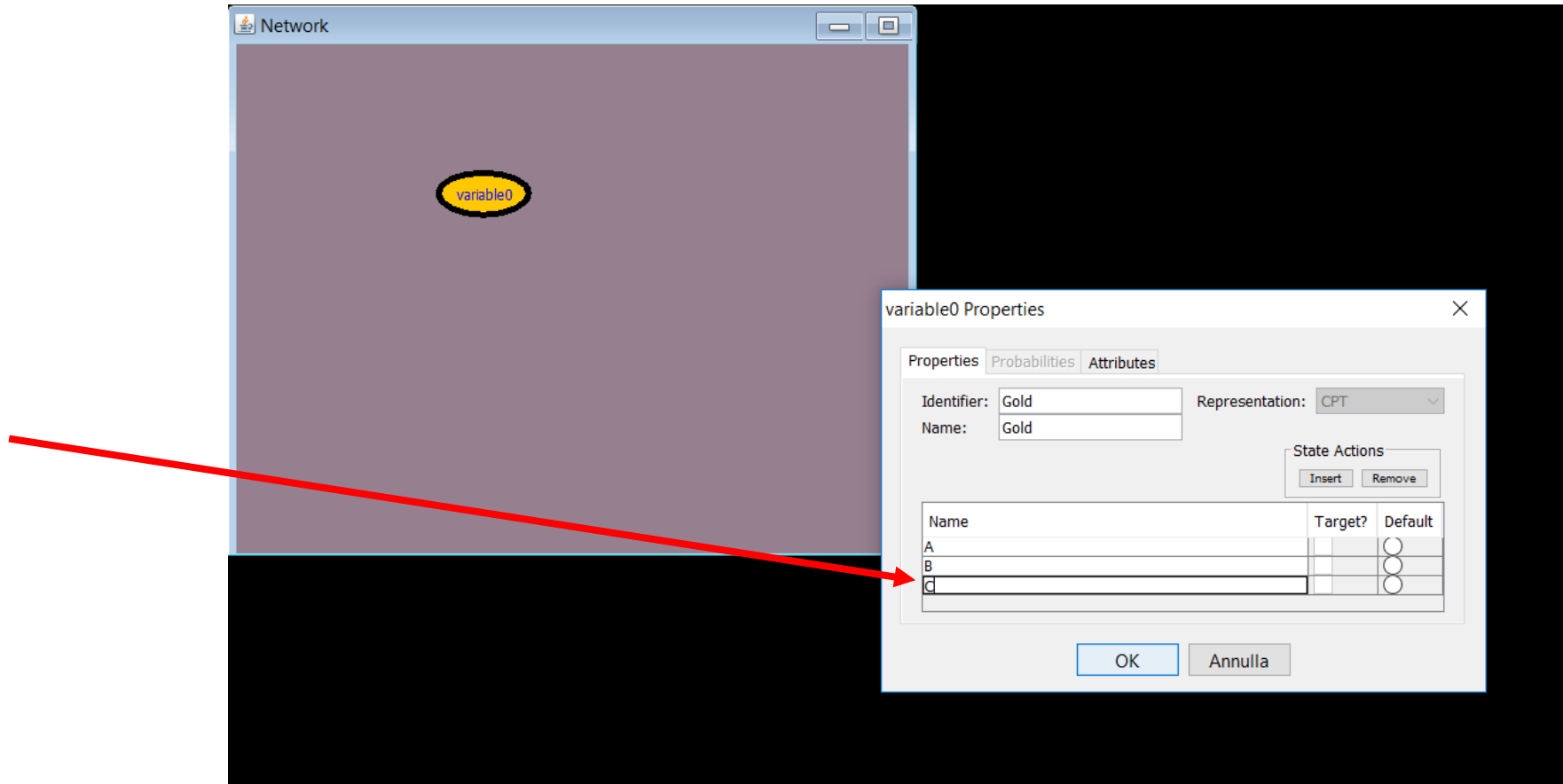
- Now you can start to create your network!

You can also add or remove some states



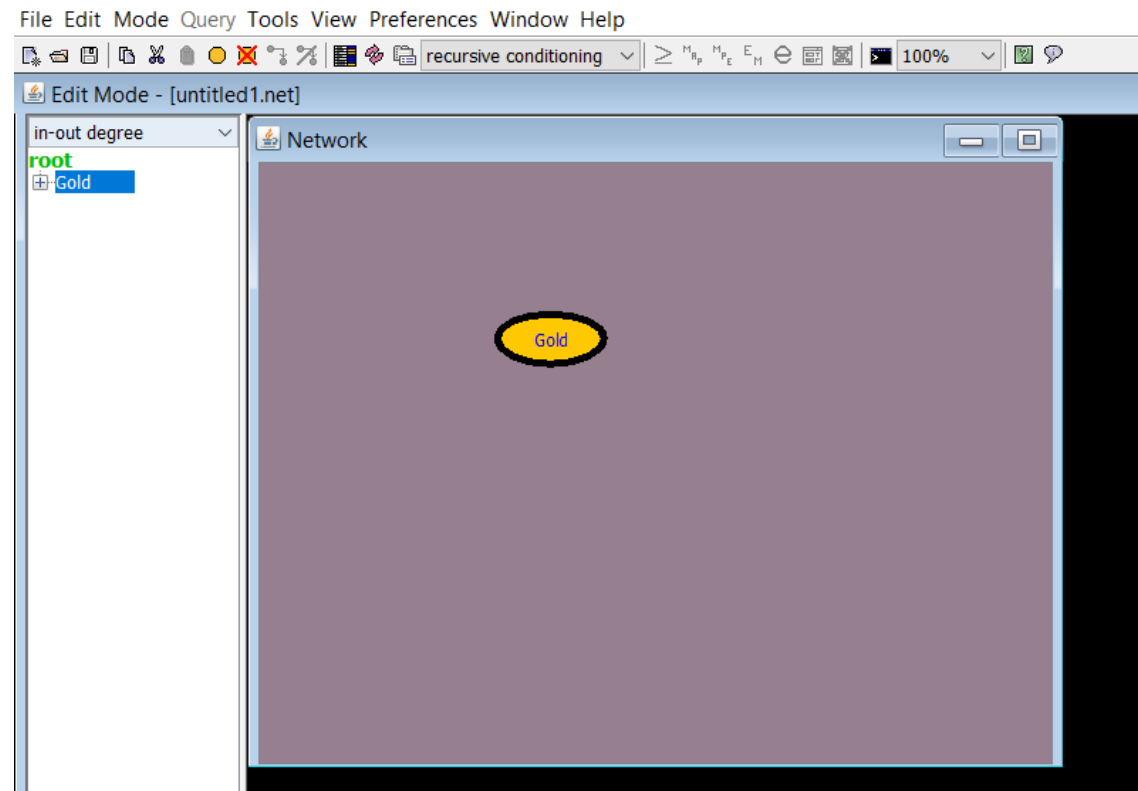
Samlam Introduction

- Now you can start to create your network!



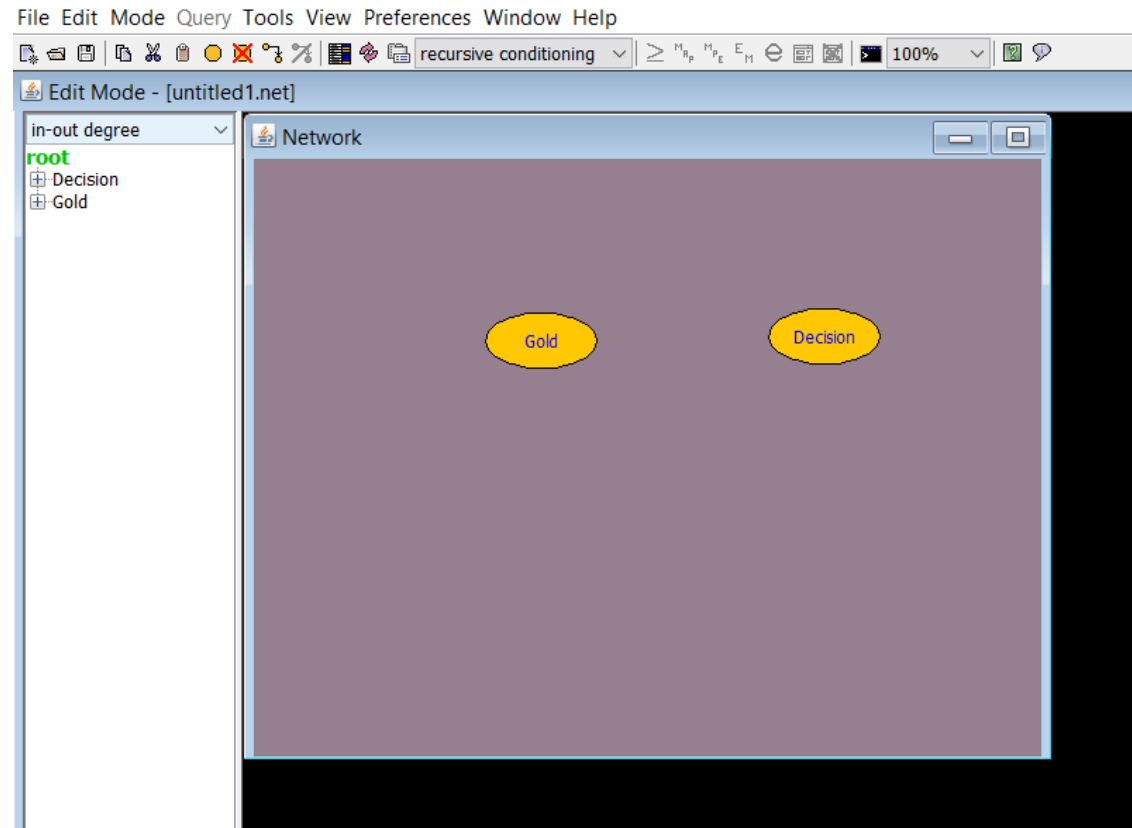
Samlam Introduction

- Clicking on «OK» you have your node



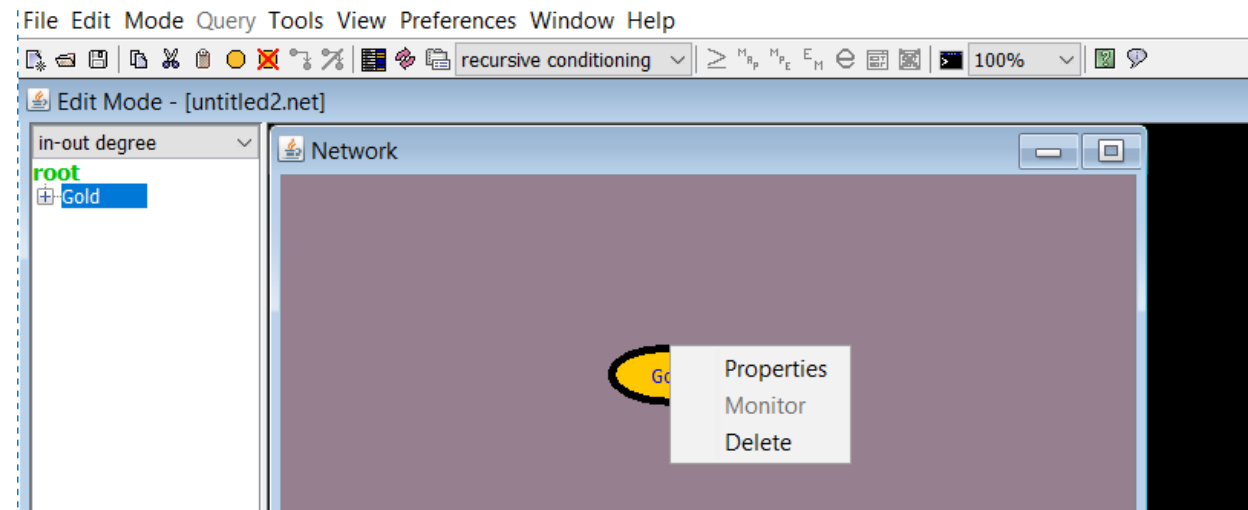
Samlam Introduction

- In this way you can create some other node:



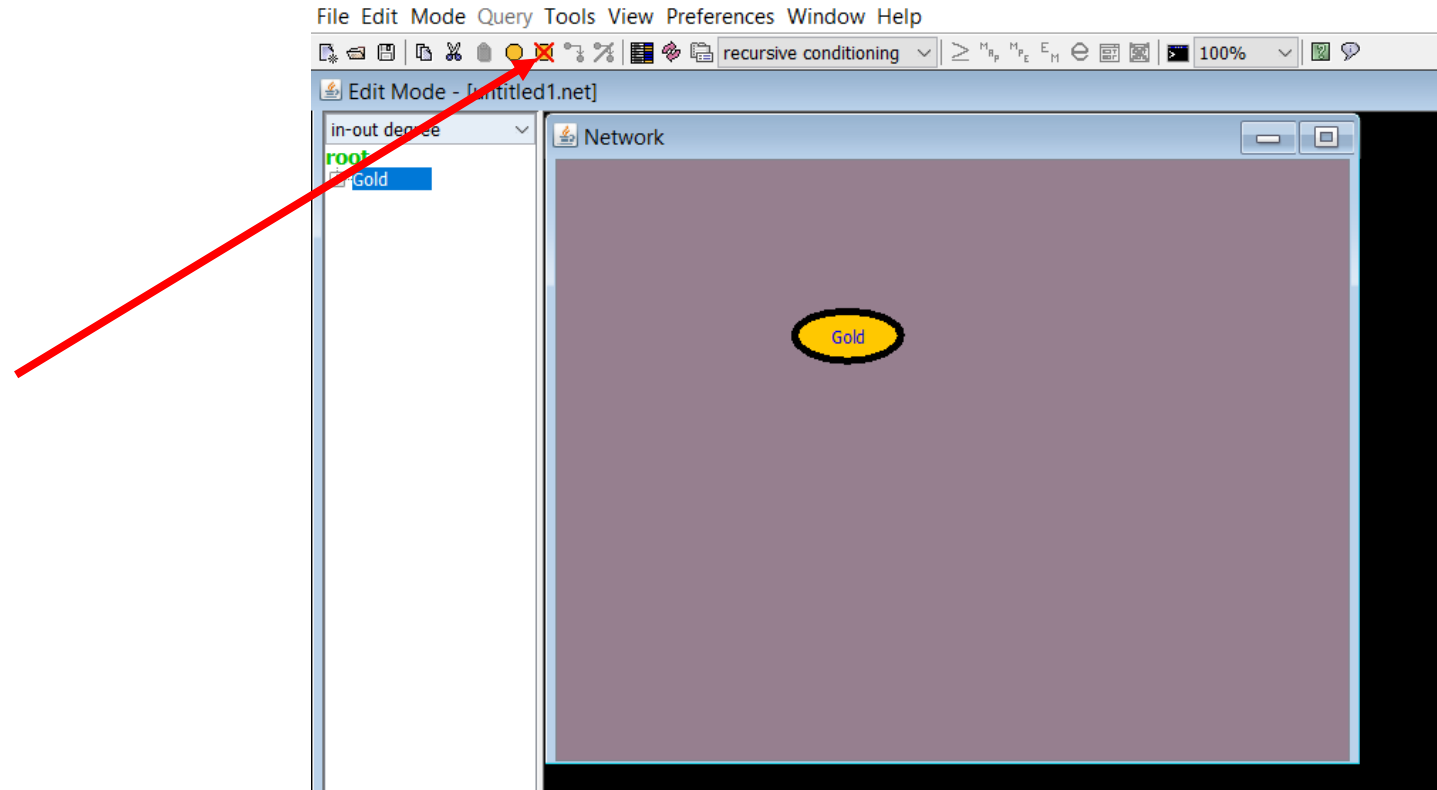
Samlam Introduction

- 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

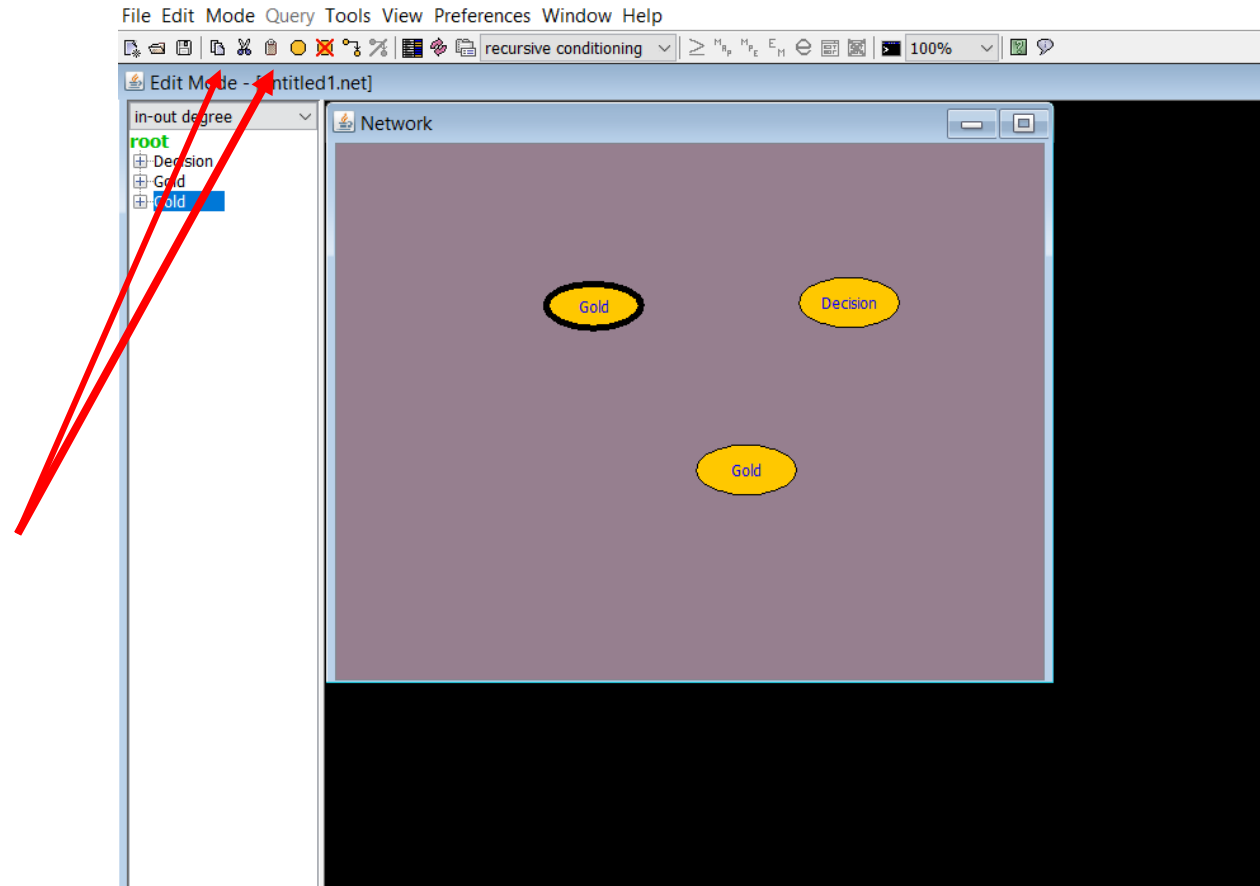
- You can delete a node also clicking on this button after node selection:



Samlam Introduction

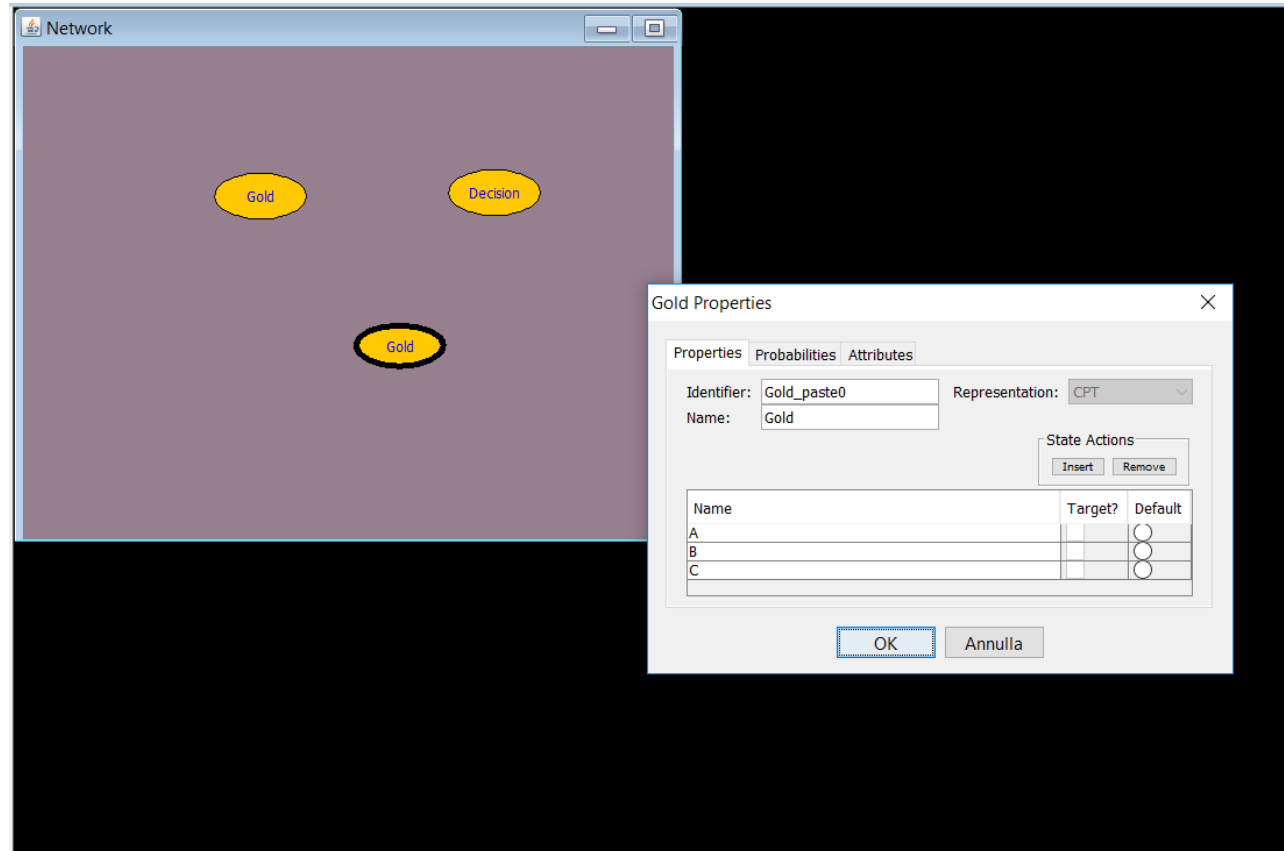
- You can also copy and paste a node and choosing its final location:

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



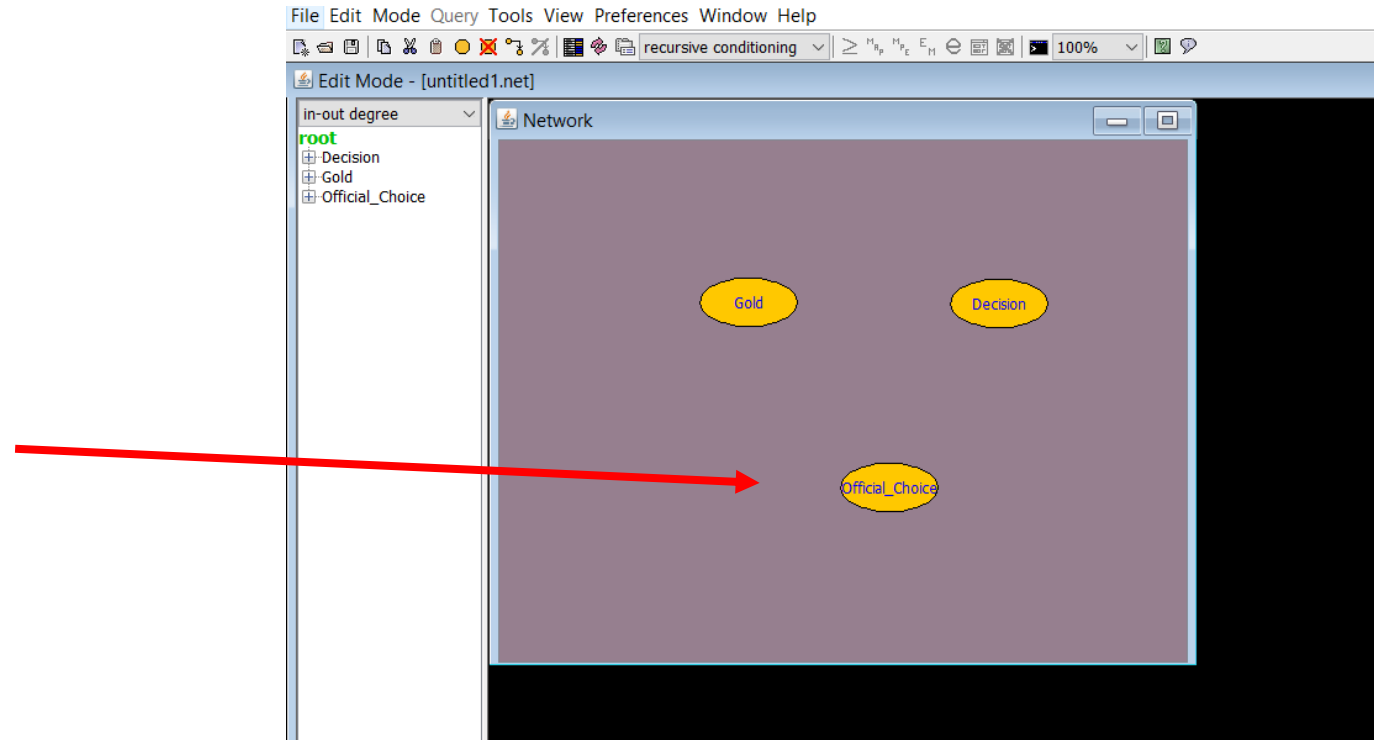
Samlam Introduction

- 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:

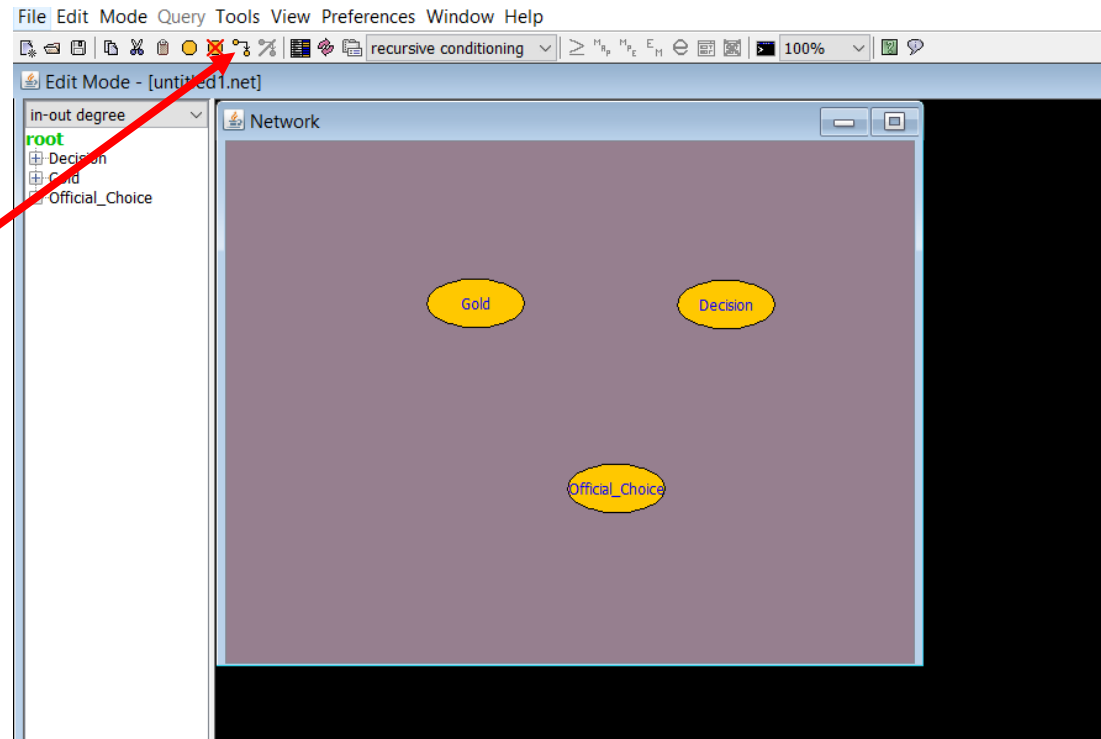


Samlam Introduction

- 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.**

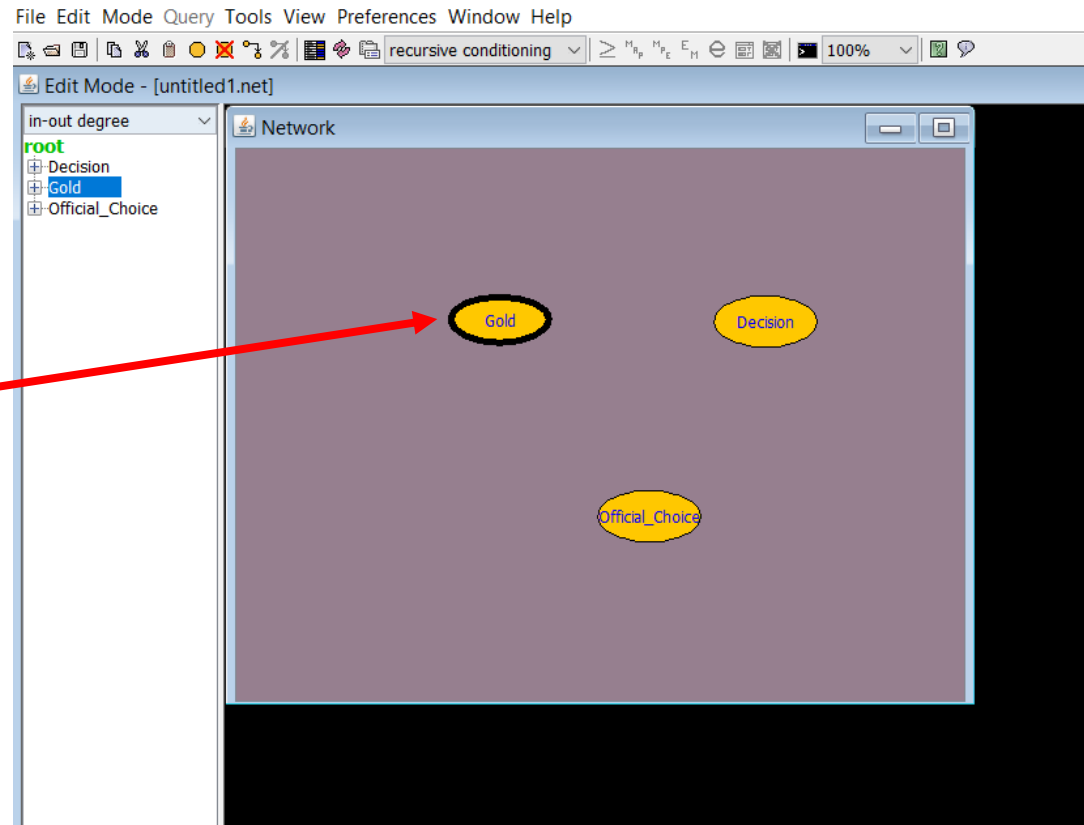


Samlam Introduction

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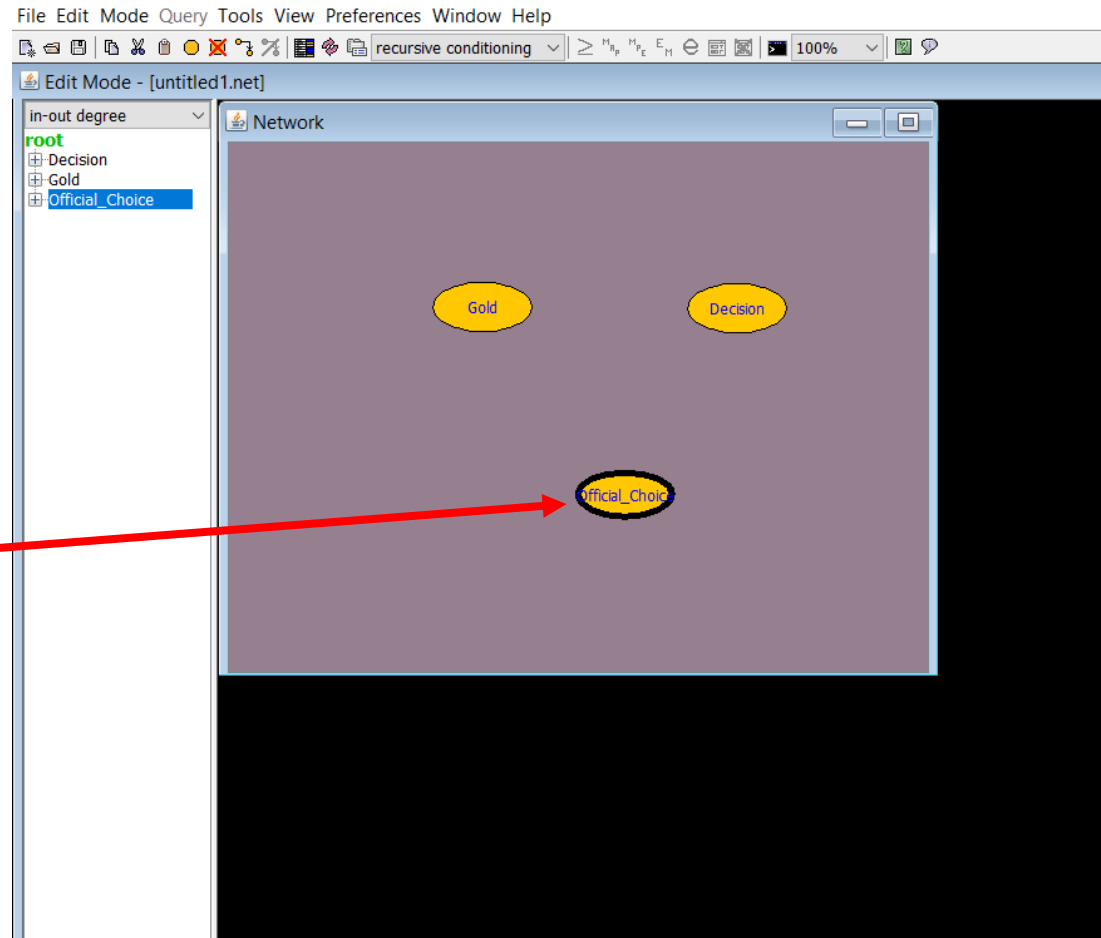


Samlam Introduction

- Now you can insert the influences between the nodes

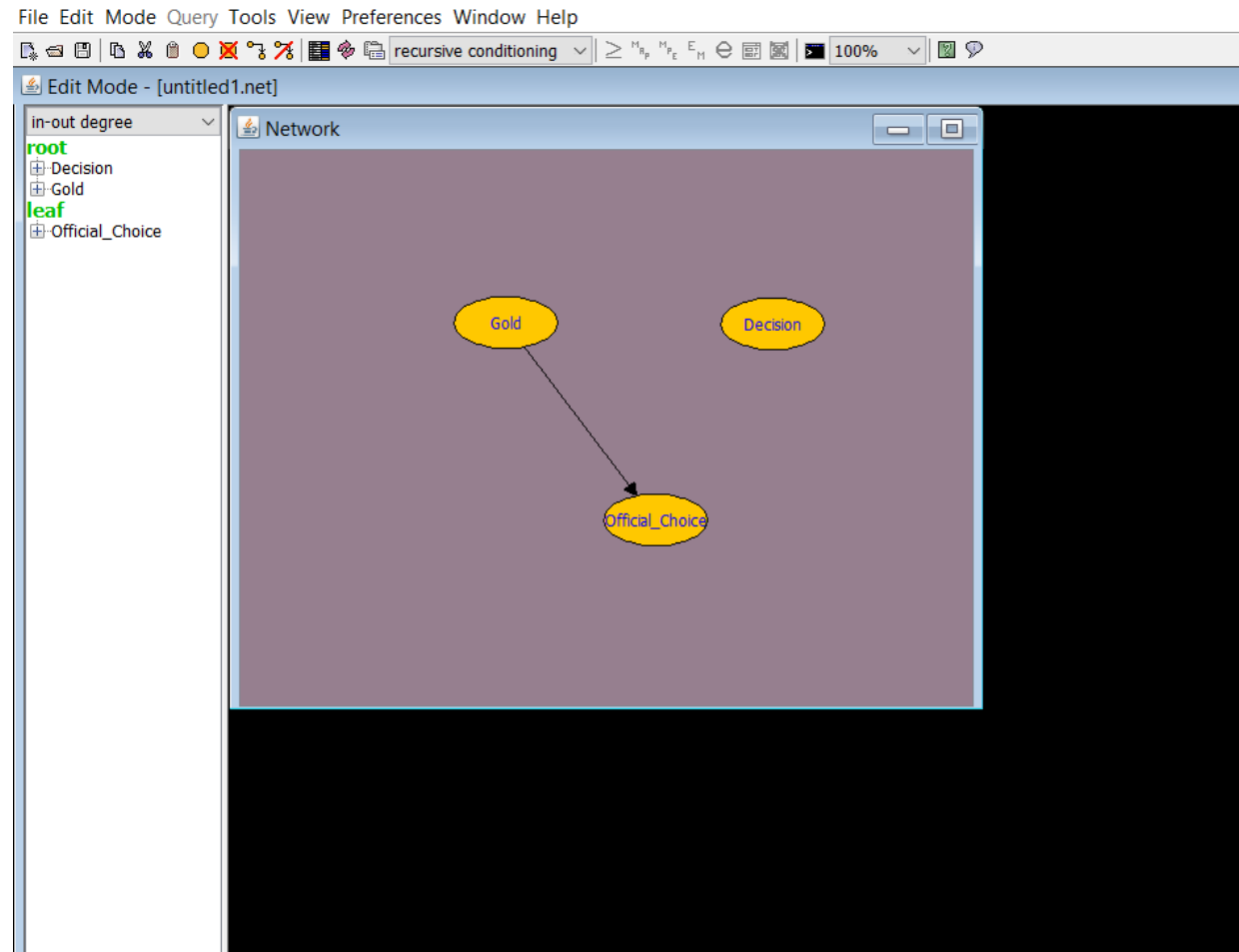
You can click here
to insert an edge
between two
nodes.

**After clicking the
button you must
choose in order
the nodes to
connect.**



Samlam Introduction

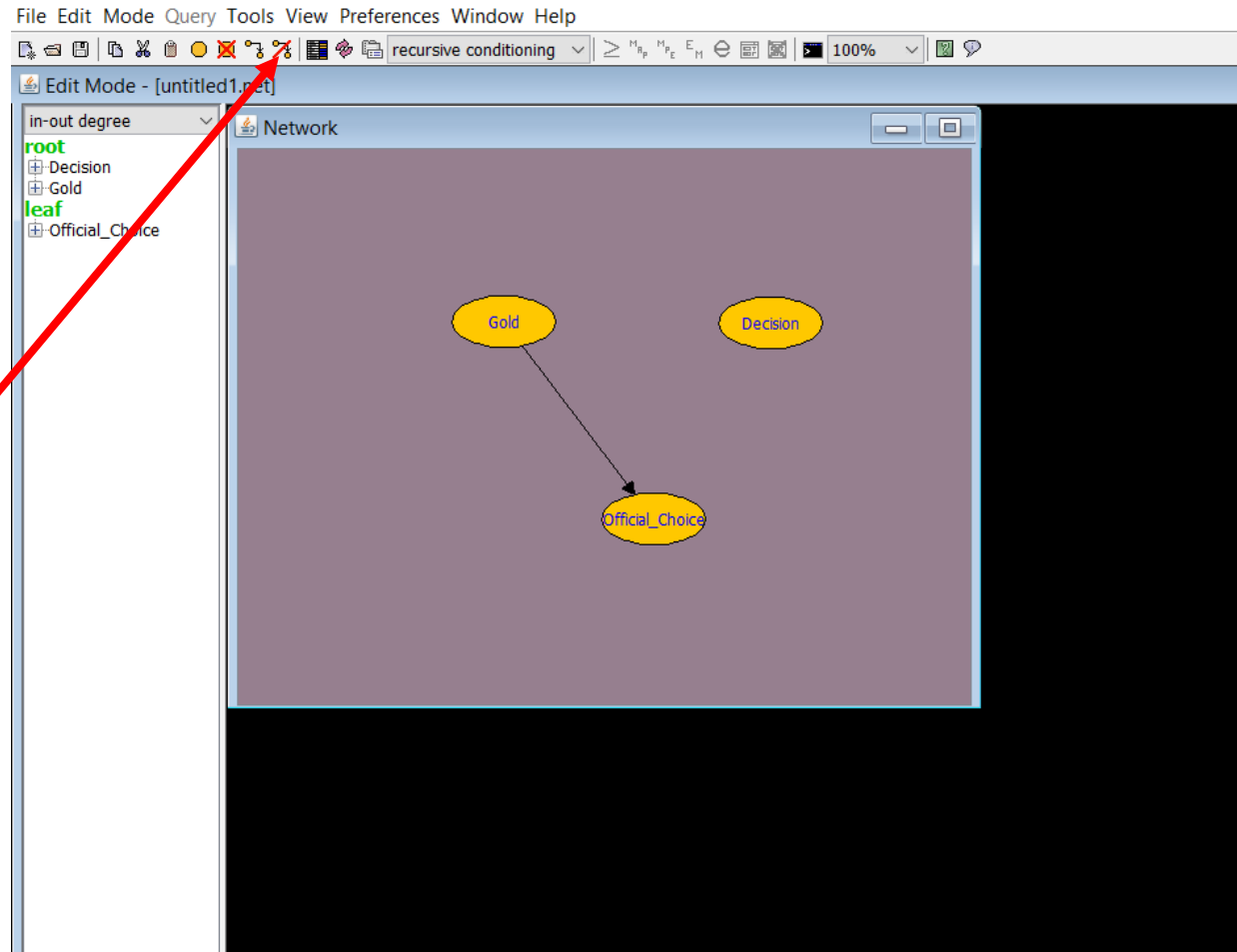
- Now you have the edge!



Samlam Introduction

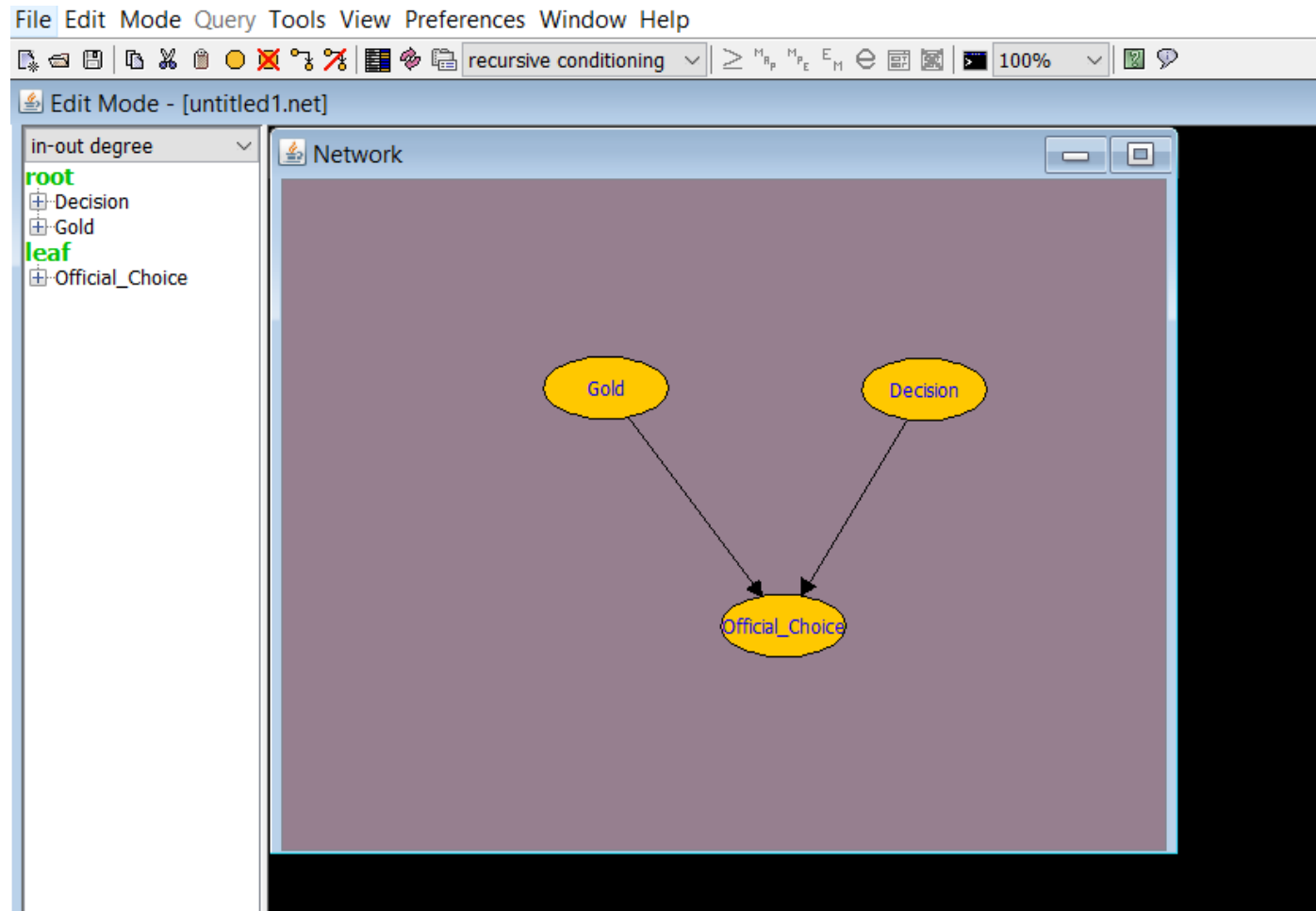
- You can also delete an edge:

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)



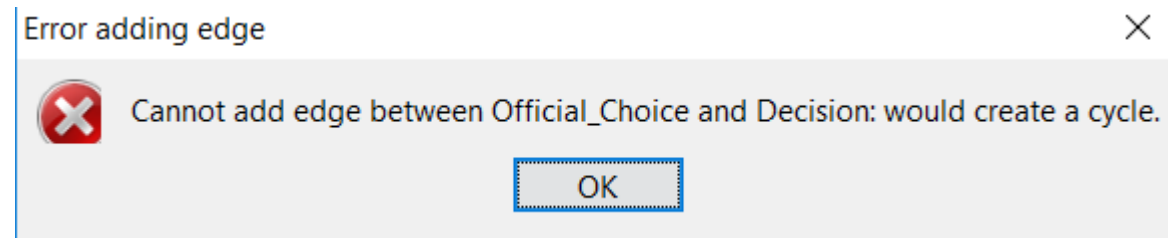
Samlam Introduction

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



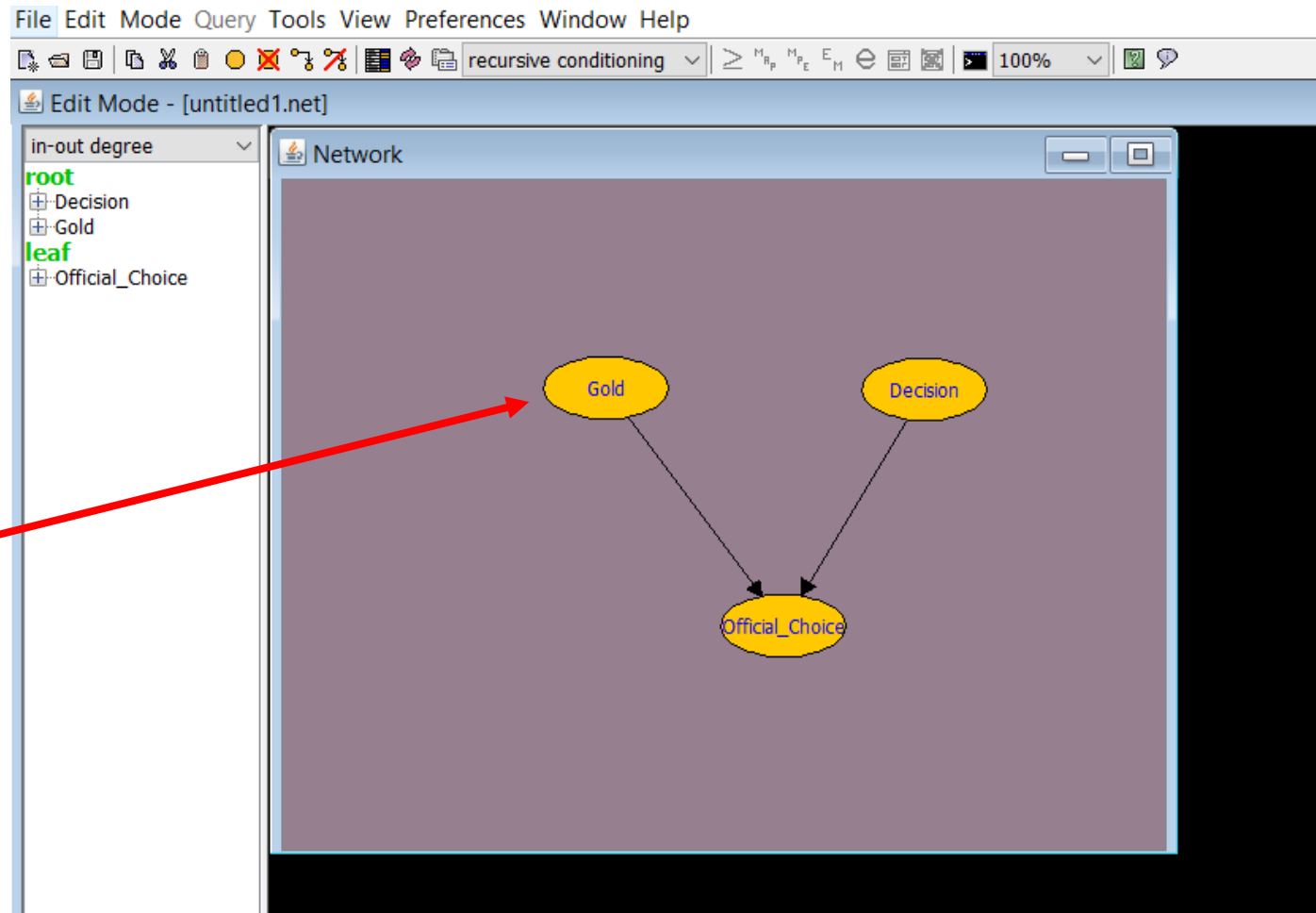
Samlam Introduction

- The program prevents you to create cycles:



Samlam Introduction

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

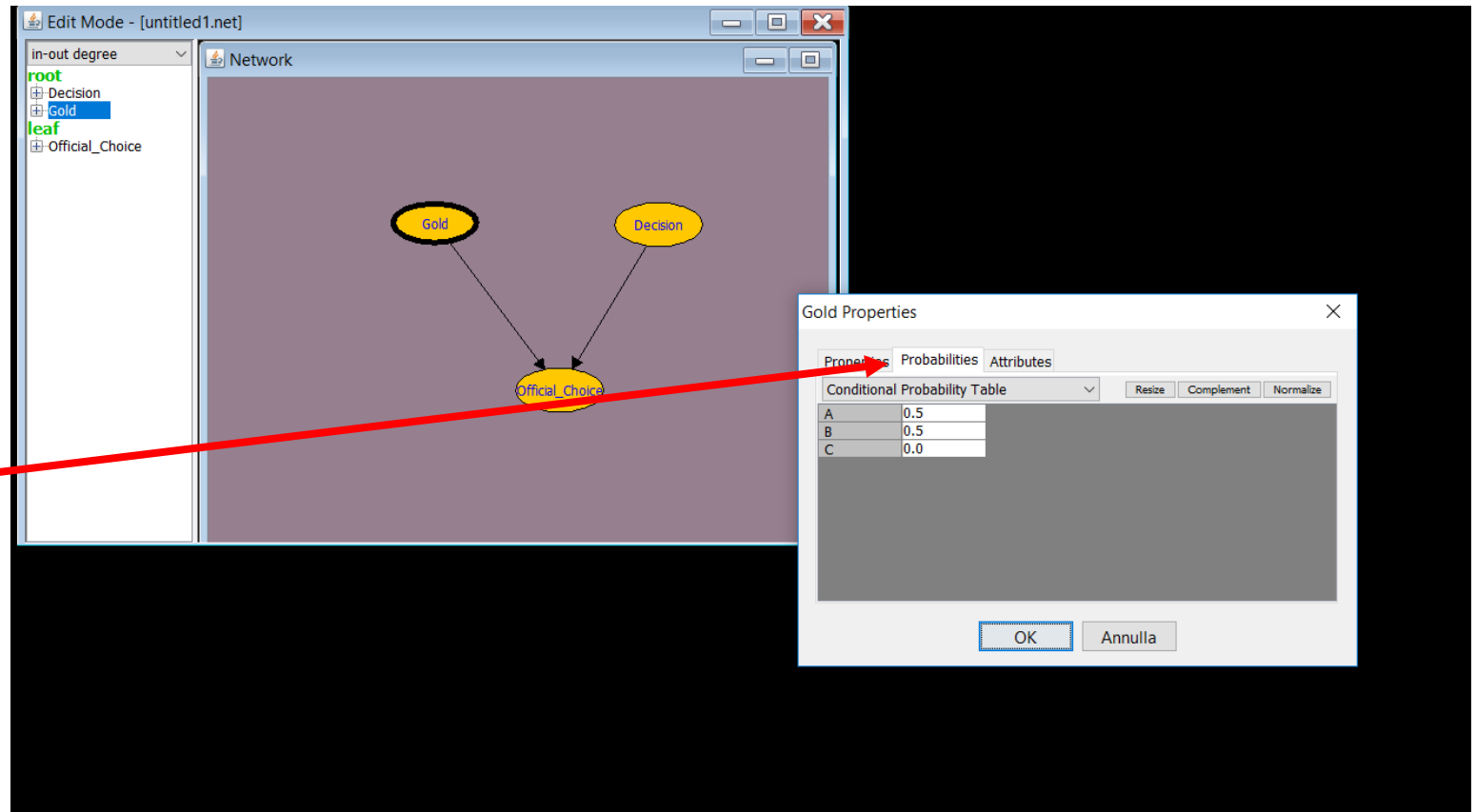


Double-clicking on a node you can see its properties and fix its CPT clicking on the pane «probabilities»

Samlam Introduction

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

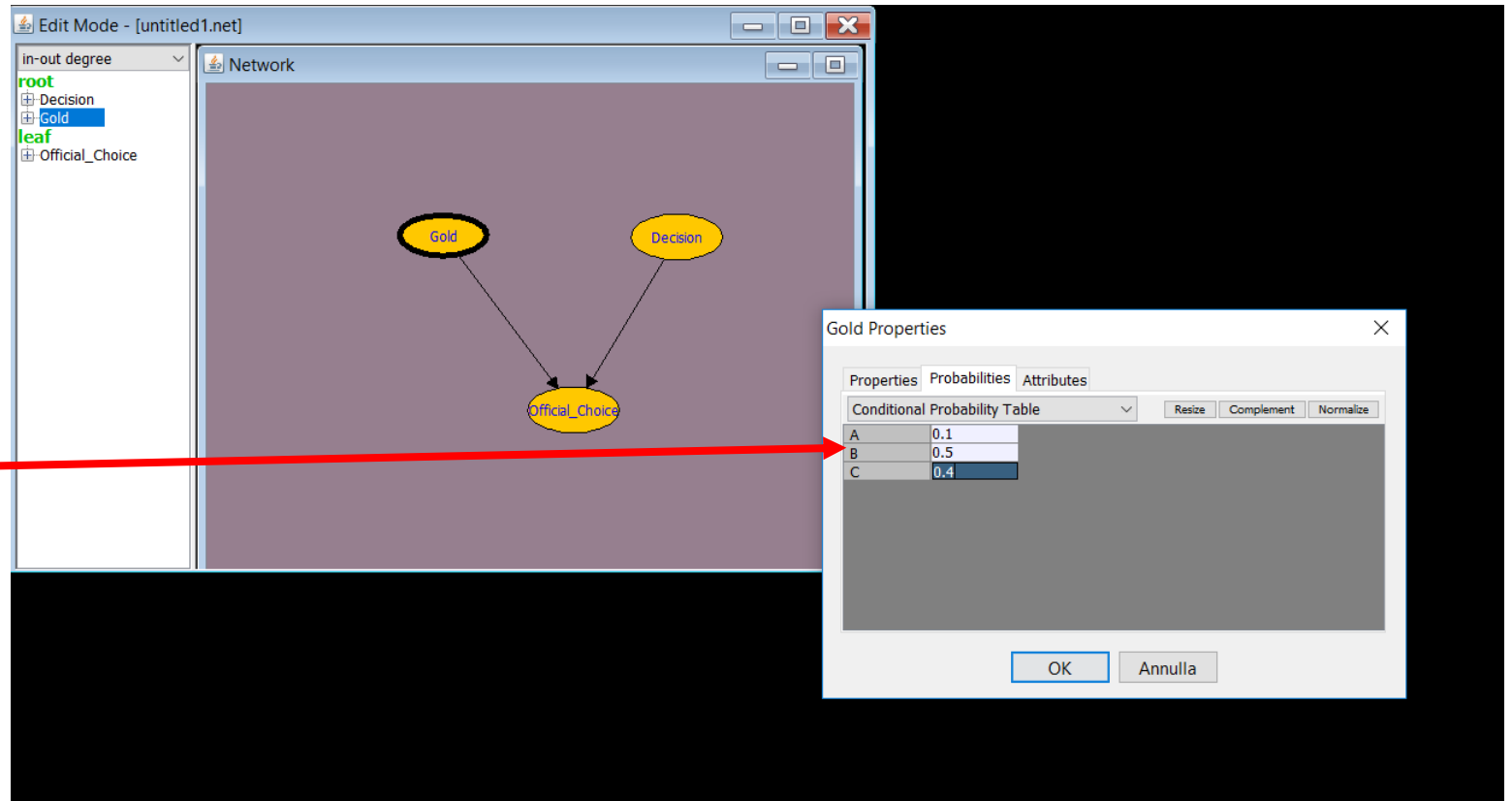
Here you can modify
the default
probabilities presents
in the CPT



Samlam Introduction

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

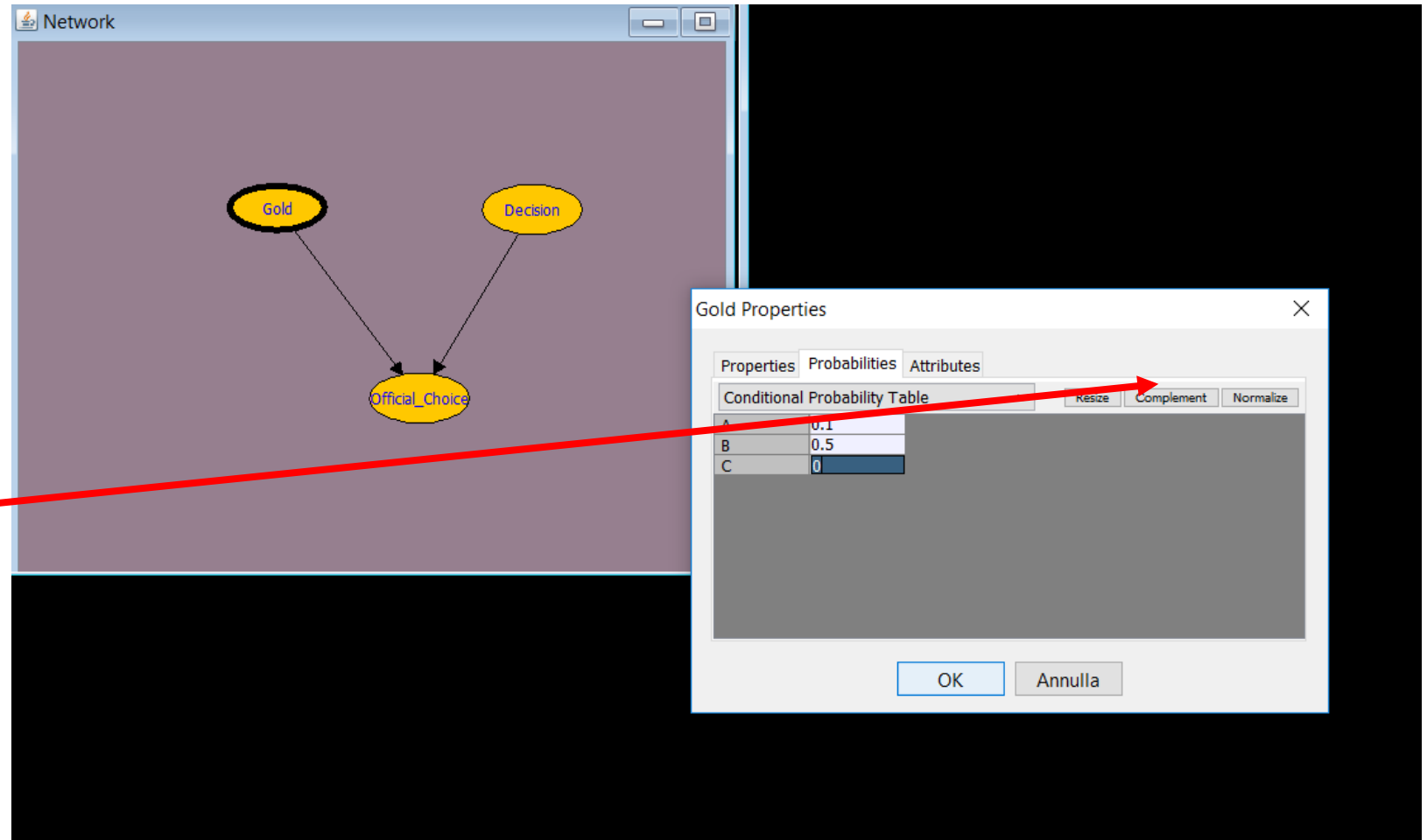
You can choose to
insert manually all
the values



Samlam Introduction

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

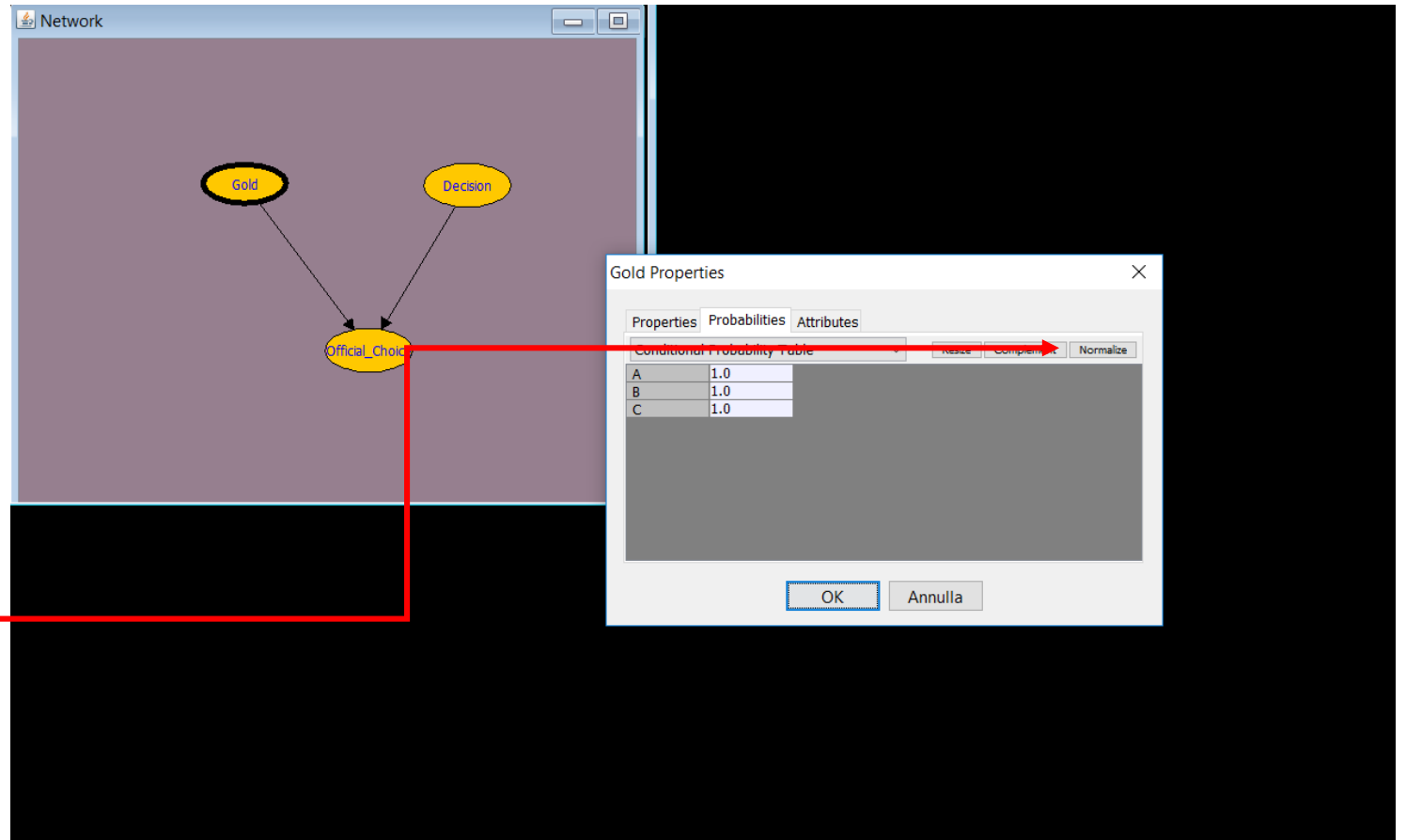
You can choose to insert manually all the values except one and then click on «Complement» to complete the table



Samlam Introduction

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

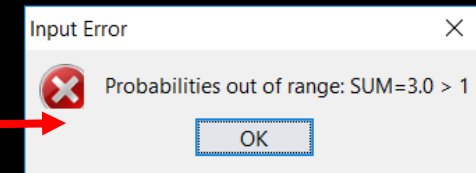
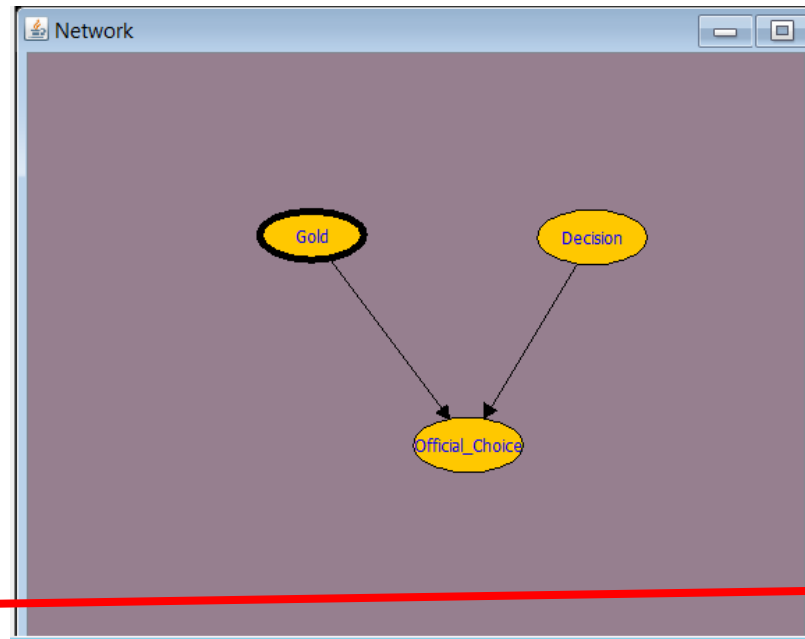
Or you can choose to insert the proportions of the values and the click on «Normalize» to obtain the exact probabilities



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

The screenshot displays the Samlam software interface. On the left, a sidebar titled 'in-out degree' shows a tree structure with 'root' (green), 'Decision' (blue), 'Gold' (blue), 'leaf' (green), and 'Official_Choice' (blue). The main window, titled 'Edit Mode - [untitled1.net]', shows a network diagram with three nodes: 'Gold' and 'Decision' (yellow ovals) pointing to 'Official_Choice' (yellow oval). A 'Gold Properties' dialog box is open in the foreground, showing the 'Probabilities' tab. It contains a 'Conditional Probability Table' with three rows: 'A', 'B', and 'C', each with a value of '0.333333...'. The dialog has 'OK' and 'Annulla' buttons at the bottom. A red arrow points from the text 'Now you can click on «OK» and save the values' to the 'OK' button.

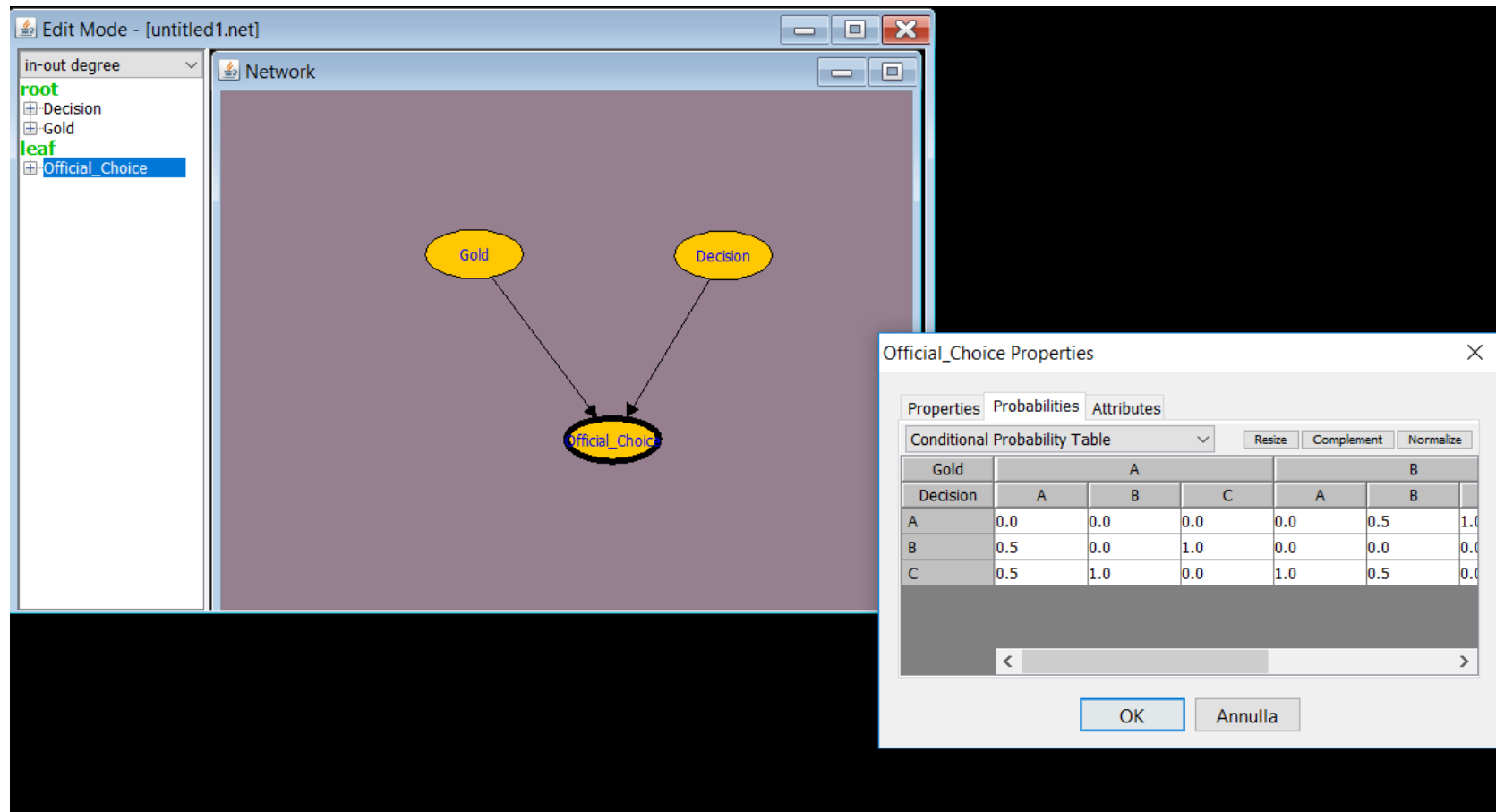
Gold Properties

Properties	Probabilities	Attributes
Conditional Probability Table		
A	0.333333...	
B	0.333333...	
C	0.333333...	

OK Annulla

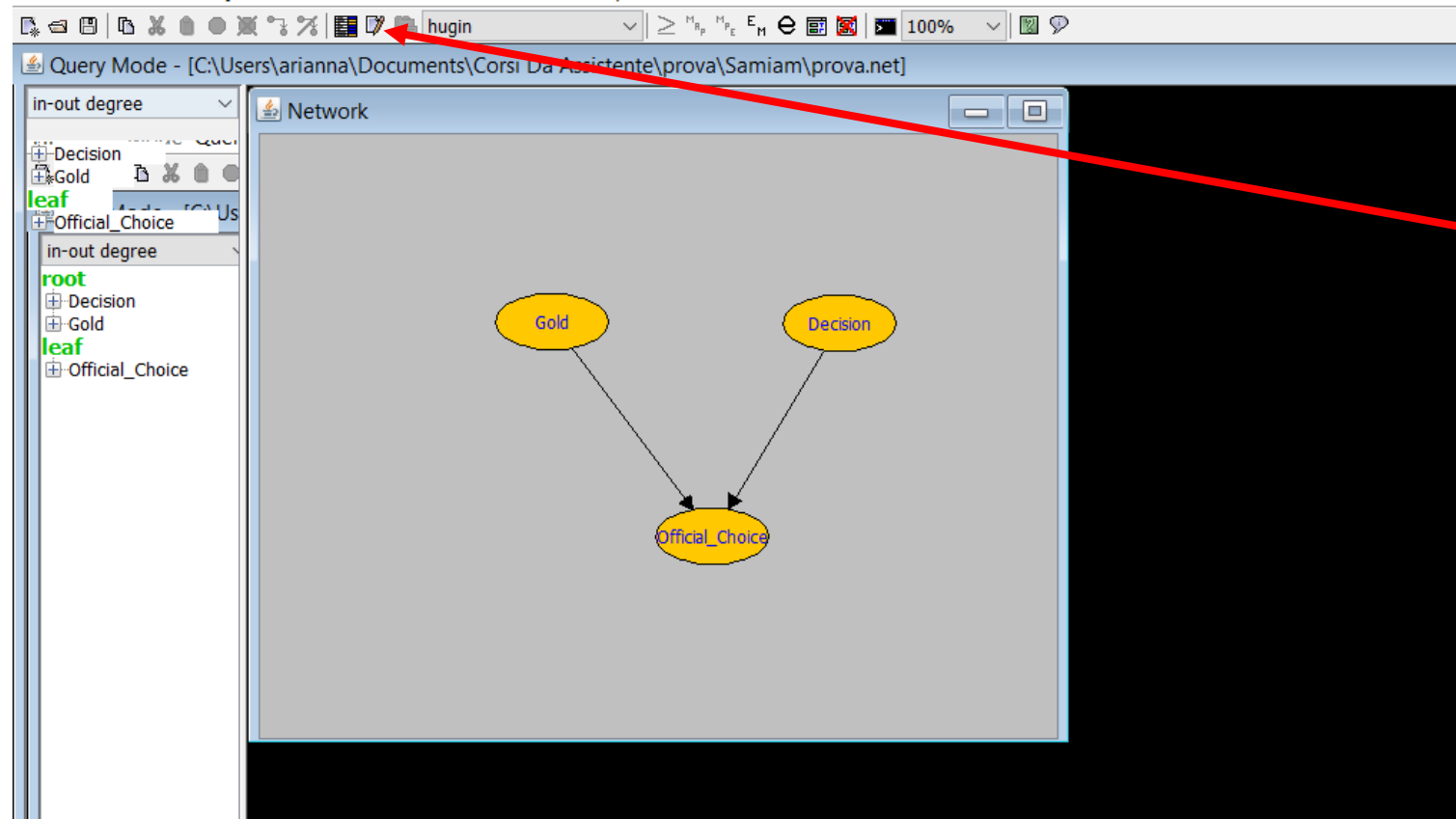
Samlam Introduction

- You can repeat the procedure for every node:



Samiam Introduction

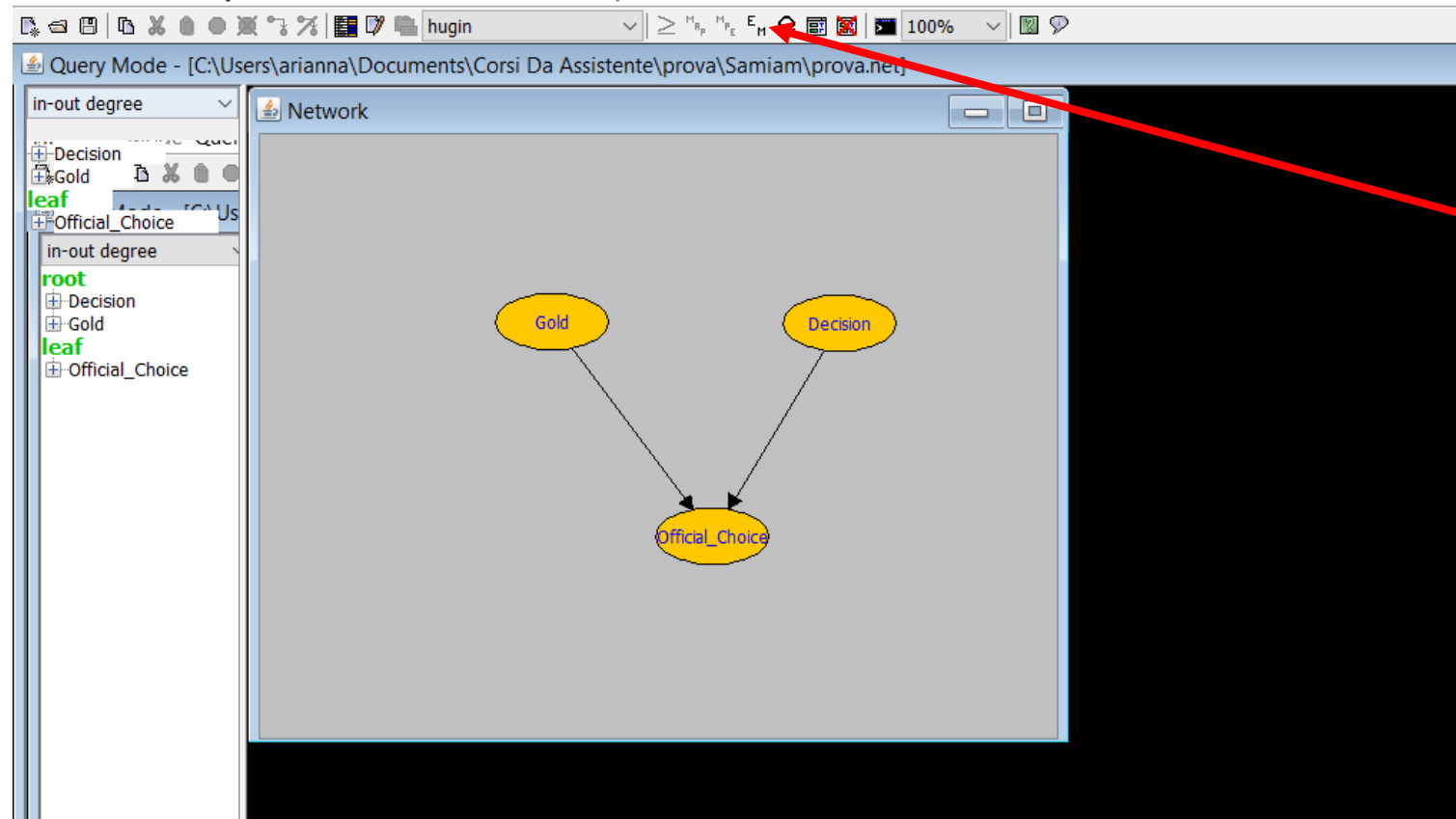
- You can also insert a dataset and let Samiam learn CPTs:



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

Samiam Introduction

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

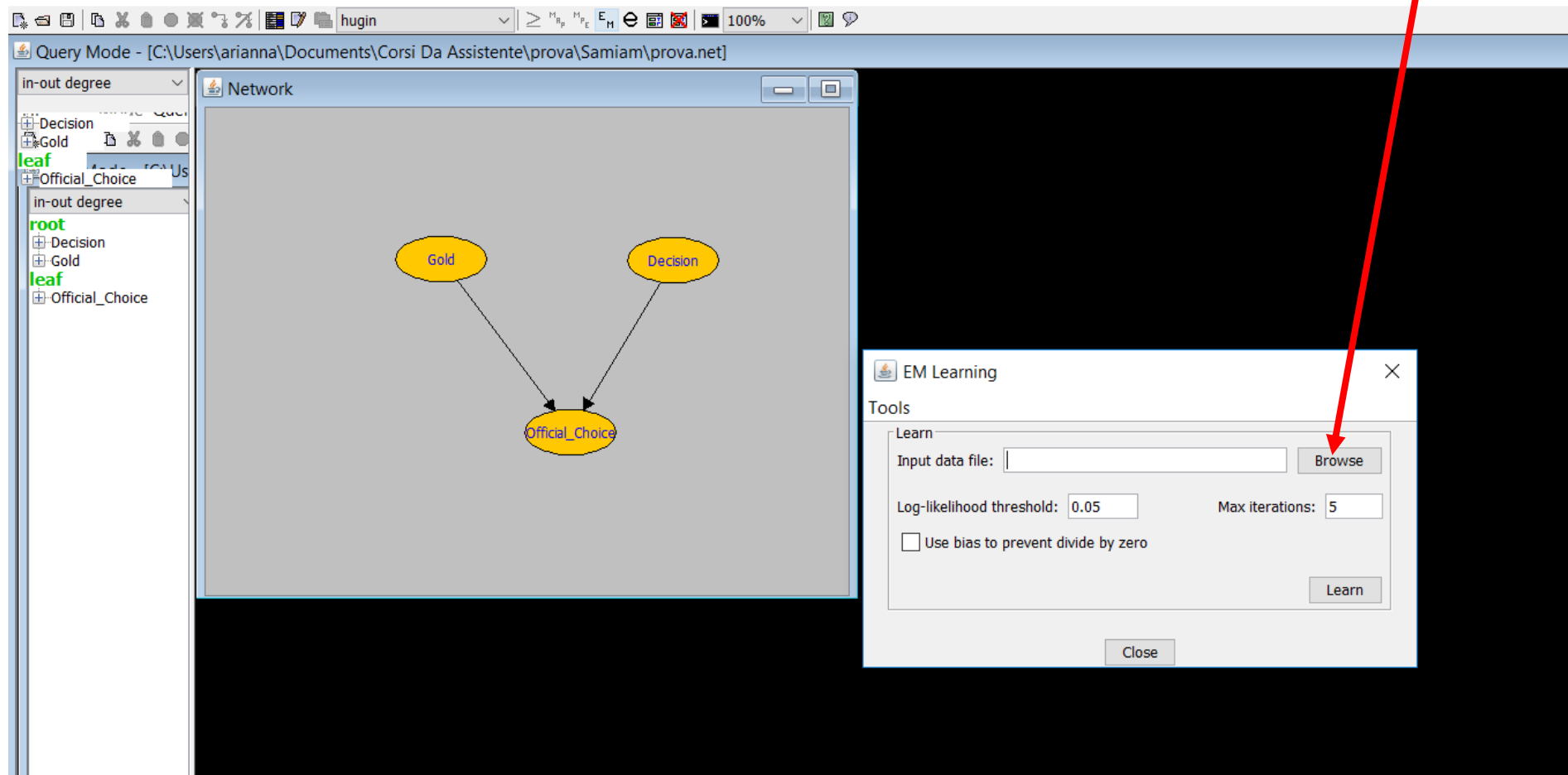


Then click on
this button

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:

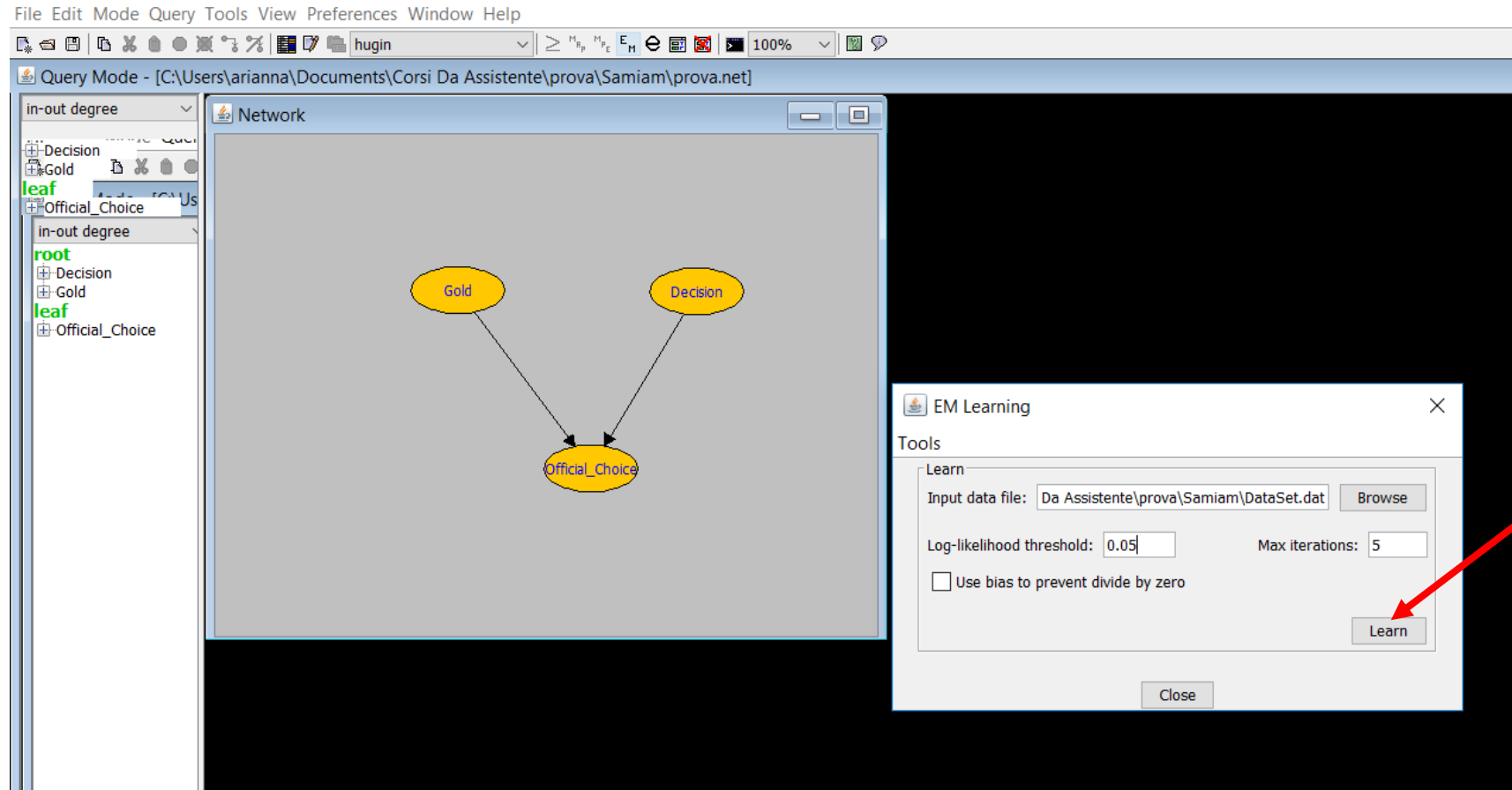
It's a text file of this format. It must contain values for all variables of the network. It can contain some missing values indicated with N/A.

The screenshot displays the Samiam software interface. On the left, a 'Query Mode' window shows a Bayesian network with three nodes: 'Gold', 'Decision', and 'Official_Choice'. 'Gold' and 'Decision' are parents of 'Official_Choice'. The 'in-out degree' panel on the left lists the nodes and their degrees. A red arrow points from the text on the left to the 'Official_Choice' node. In the center, a 'Network' window shows the same graph. On the right, a 'DataSet.dat' window displays a list of 12 data rows, each containing values for 'Gold', 'Decision', and 'Official_Choice'. Below the dataset, an 'EM Learning' window is visible with options for 'Learn', 'Input data file', 'Log-likelihood threshold', and 'Use bias to priors'. A 'Close' button is at the bottom right of the EM Learning window.

	Gold	Decision	Official_Choice
1	Gold	Decision	Official_Choice
2	A	A	B
3	B	B	A
4	A	B	C
5	A	B	C
6	A	A	B
7	C	C	B
8	C	C	A
9	C	A	B
10	C	A	B
11	C	A	B
12	B	C	A

Samlam Introduction

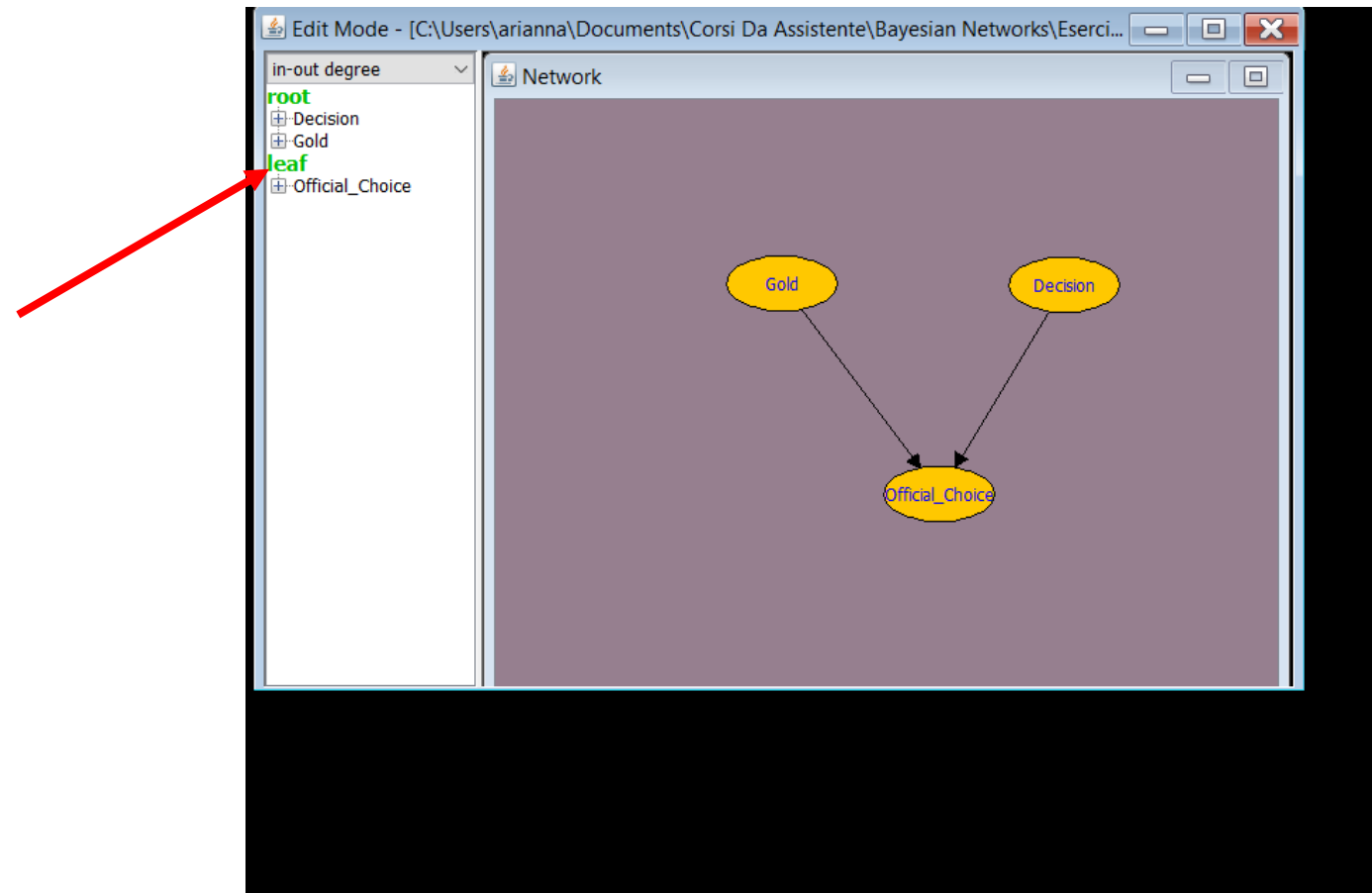
- You can also insert a dataset and let Samiam learn CPTs:



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

Samlam Introduction

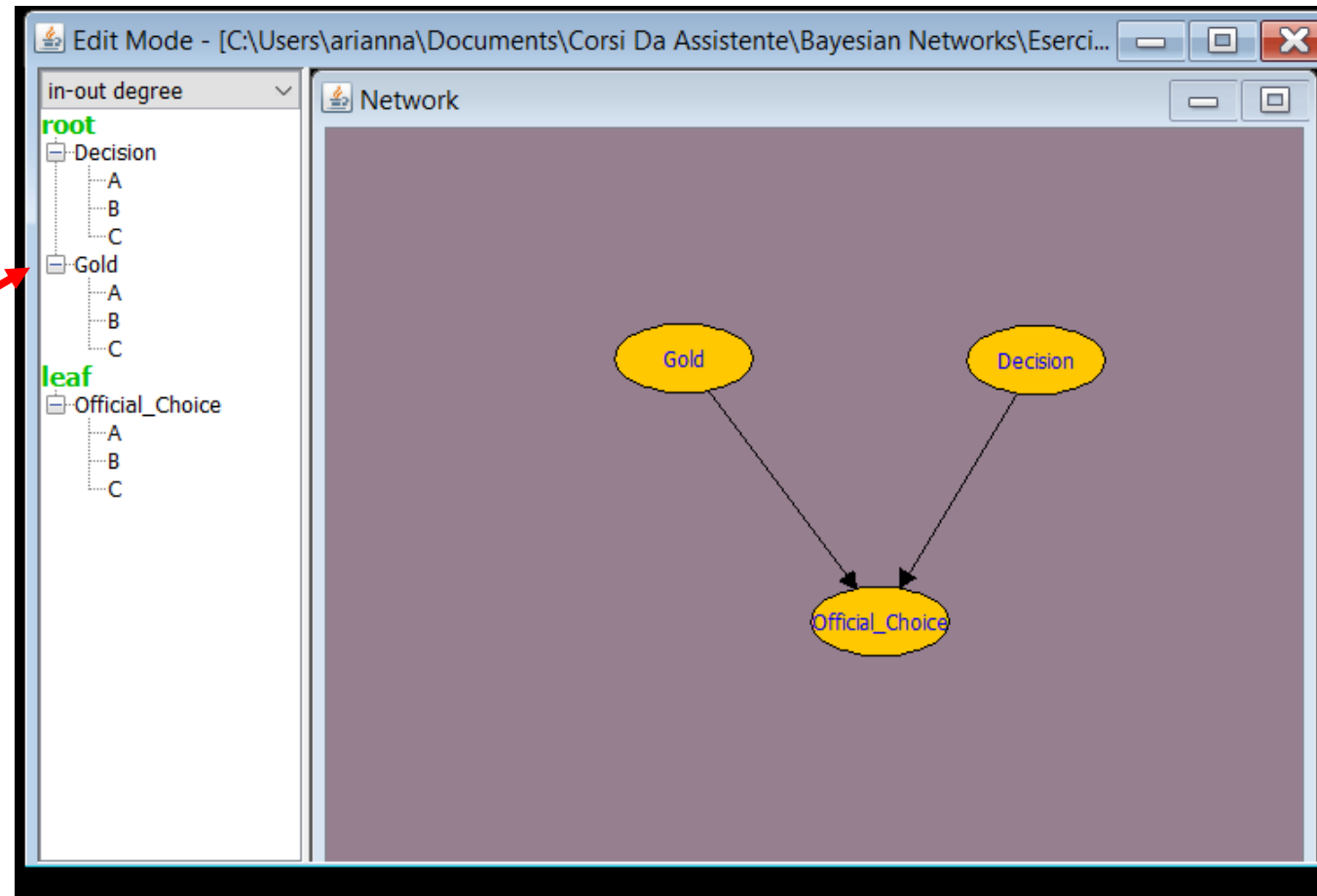
- You can see the structure of your network in the left-panel:



Samlam Introduction

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

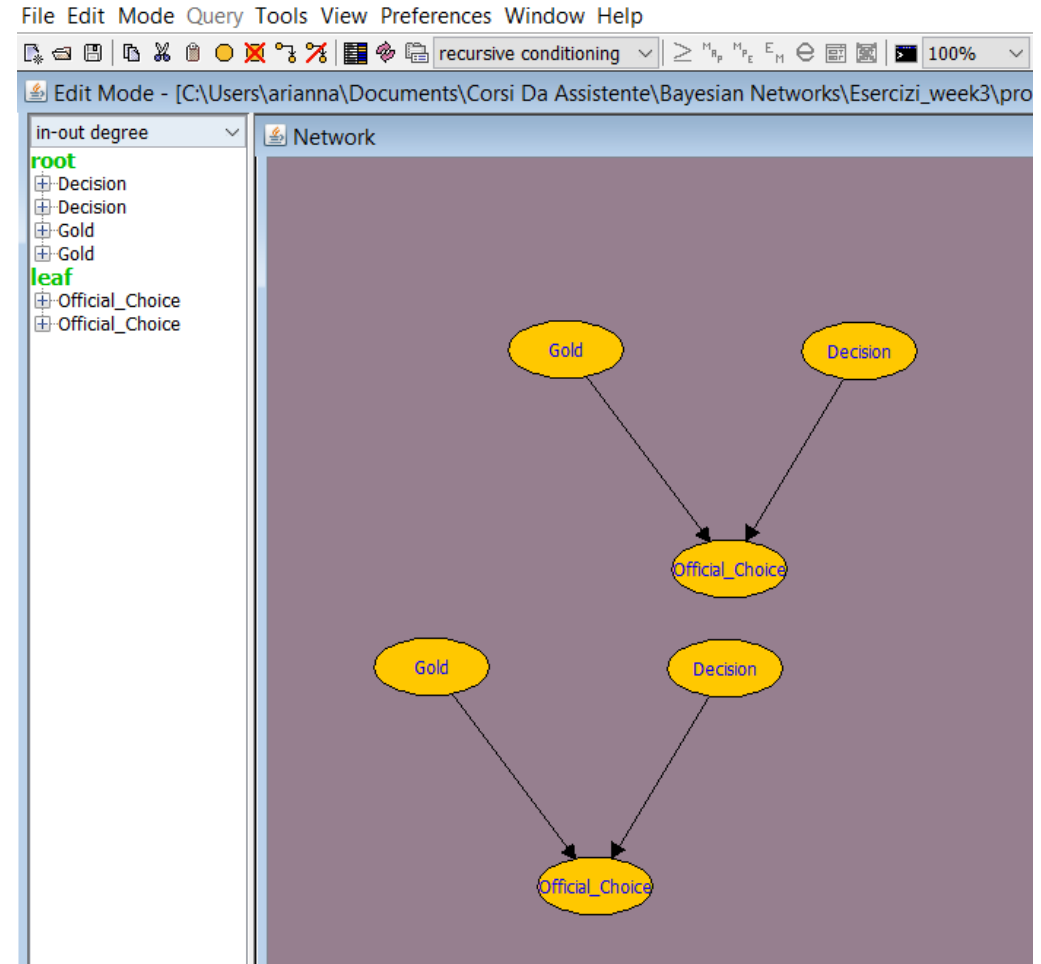
You can also expand it and see the states of each variable



Samlam Introduction

- You can also copy your network:

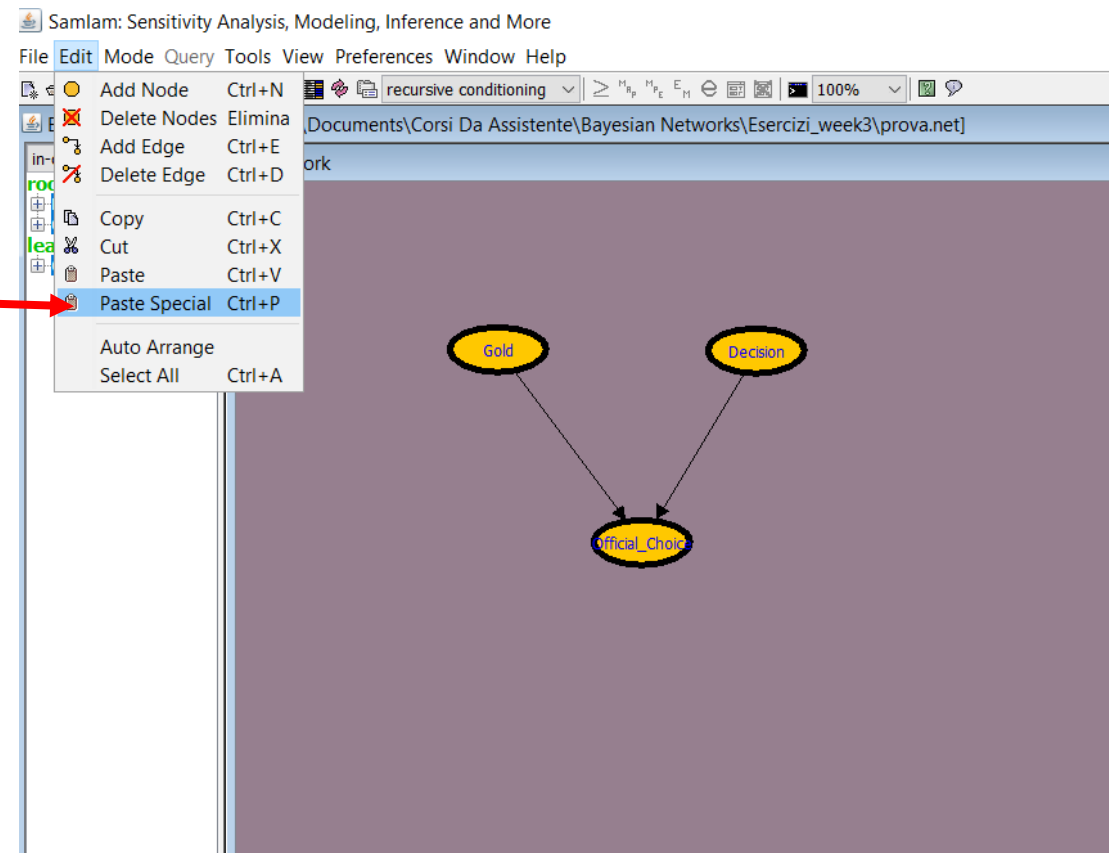
You can select all the network and copy it. This new network is equal to the first one (same nodes with same names – different identifiers, same edges and same CPTs)



Samlam Introduction

- You can also copy your network:

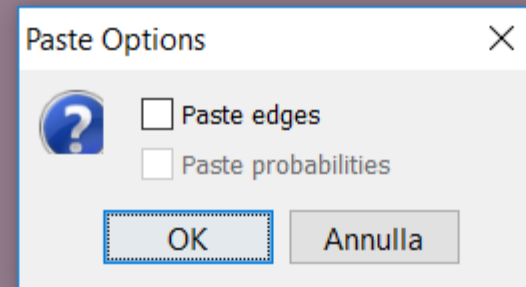
You can choose to paste
only the nodes with Edit
-> Paste Special



Samlam Introduction

- You can also copy your network:

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

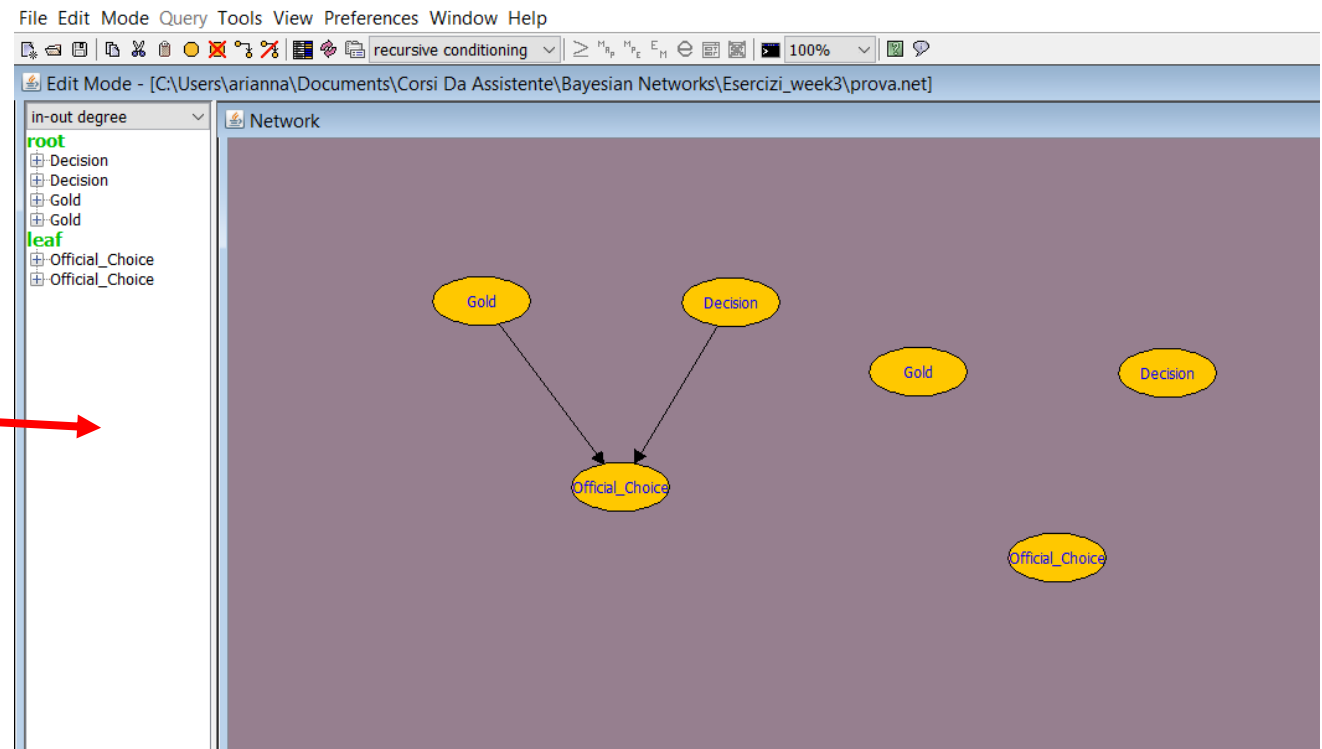


Samlam Introduction

- You can also copy your network:

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

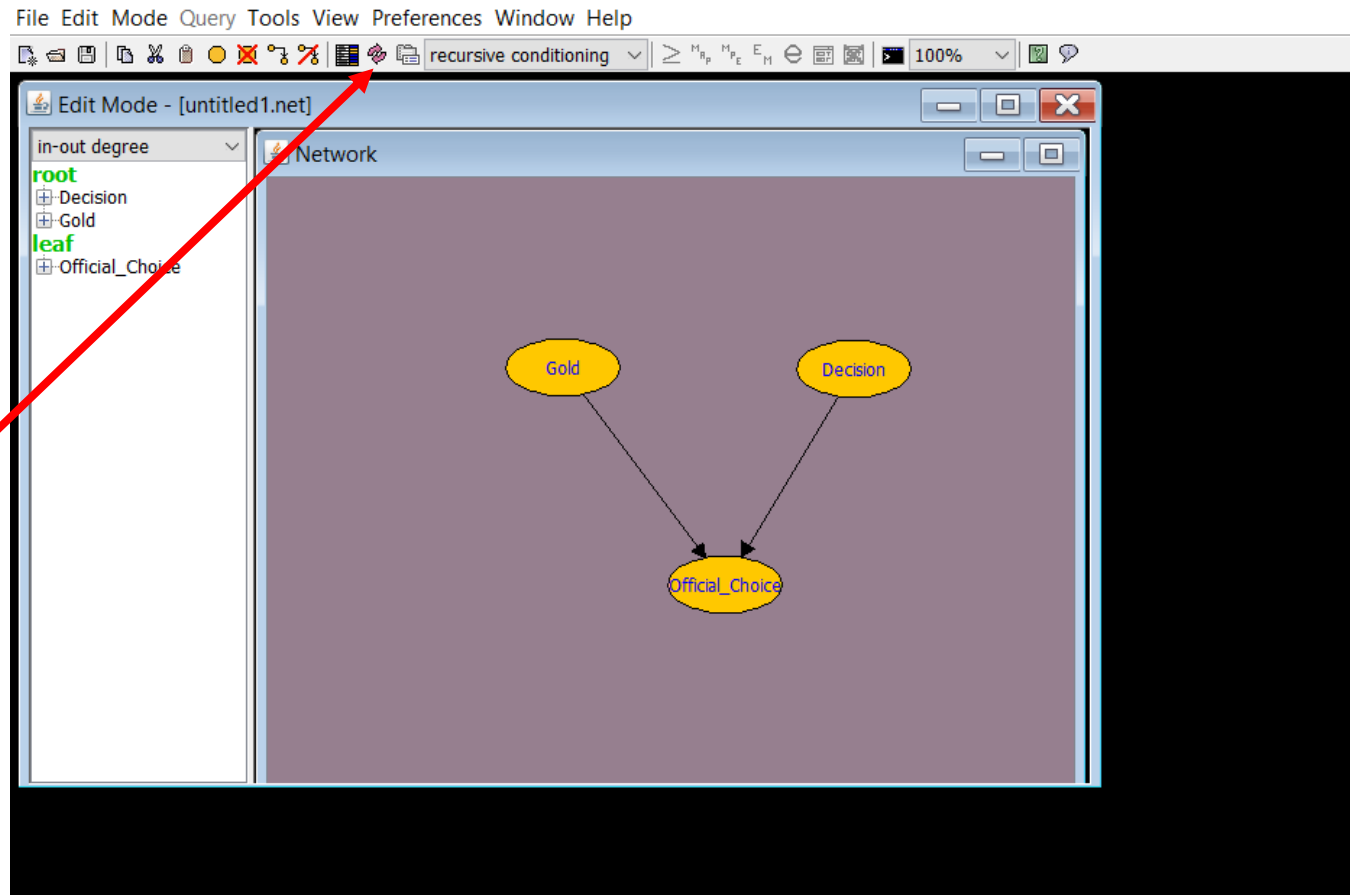
In this case **only the
CPTs of the root nodes
are retained**



Samlam Introduction

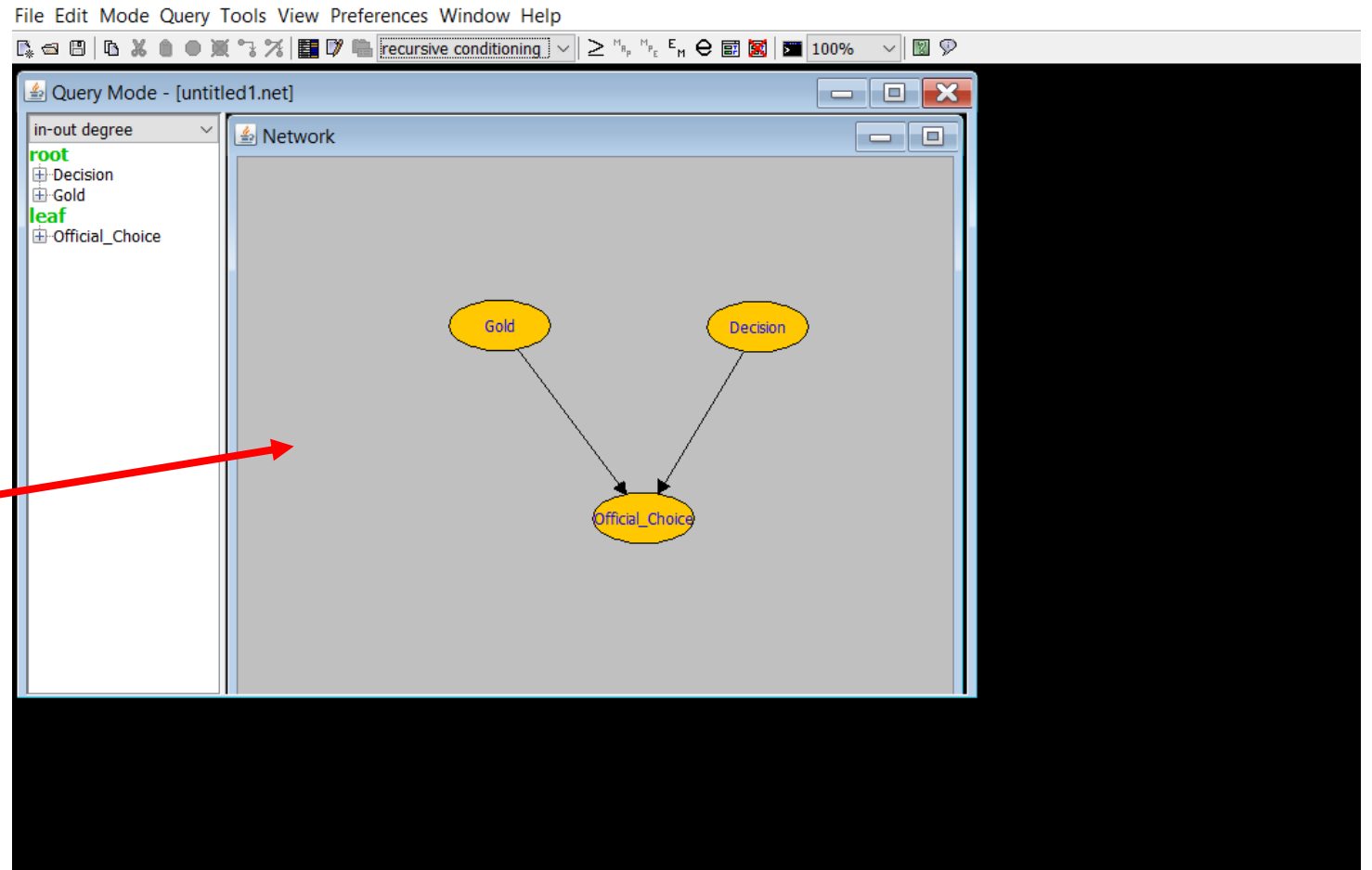
- Now you can ask some query to the network:

Clicking on this button you can enter in the query mode



Samlam Introduction

- Now you can ask some query to the network:

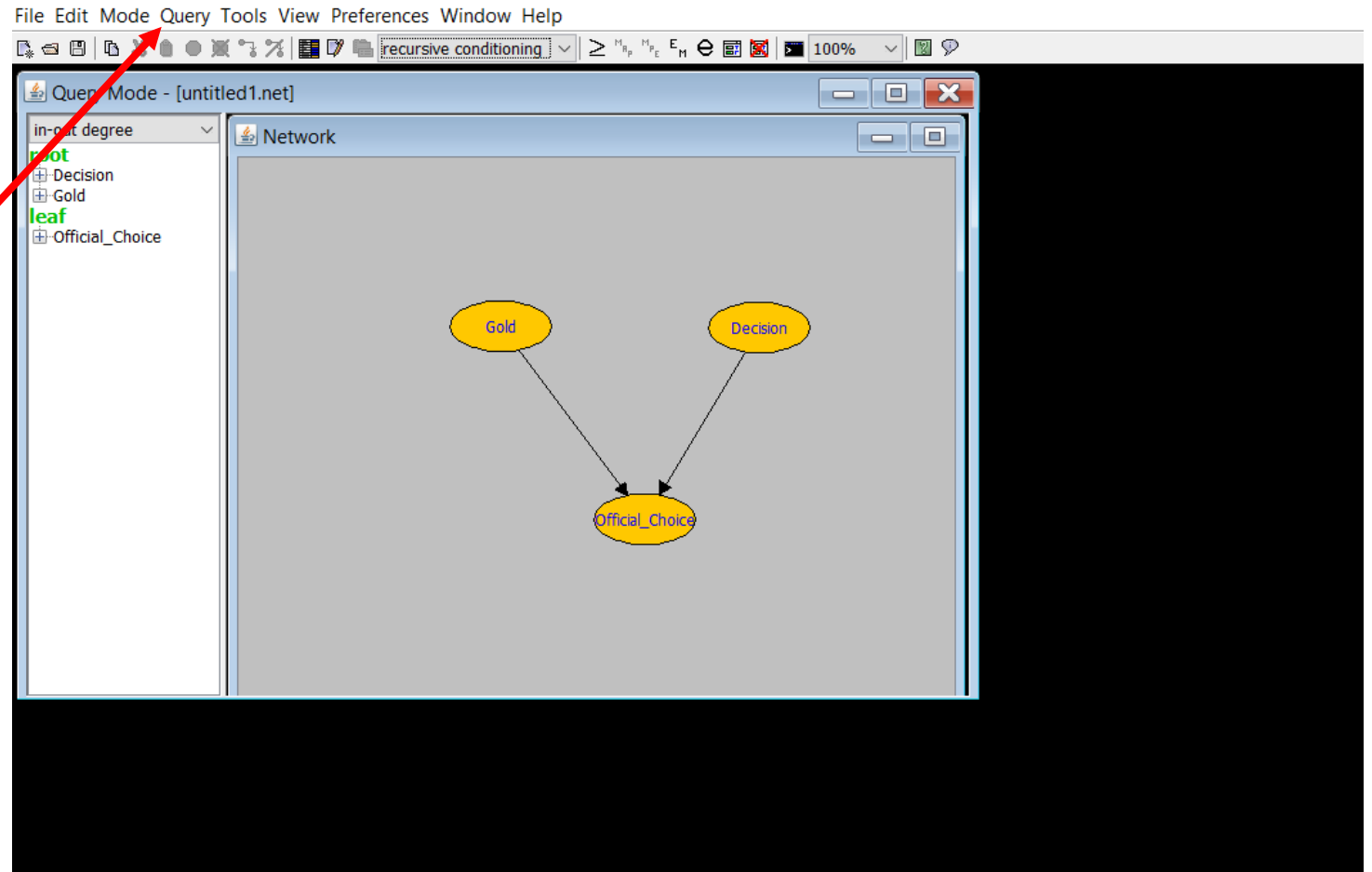


The query mode
has a different
layout

Samlam Introduction

- Now you can ask some query to the network:

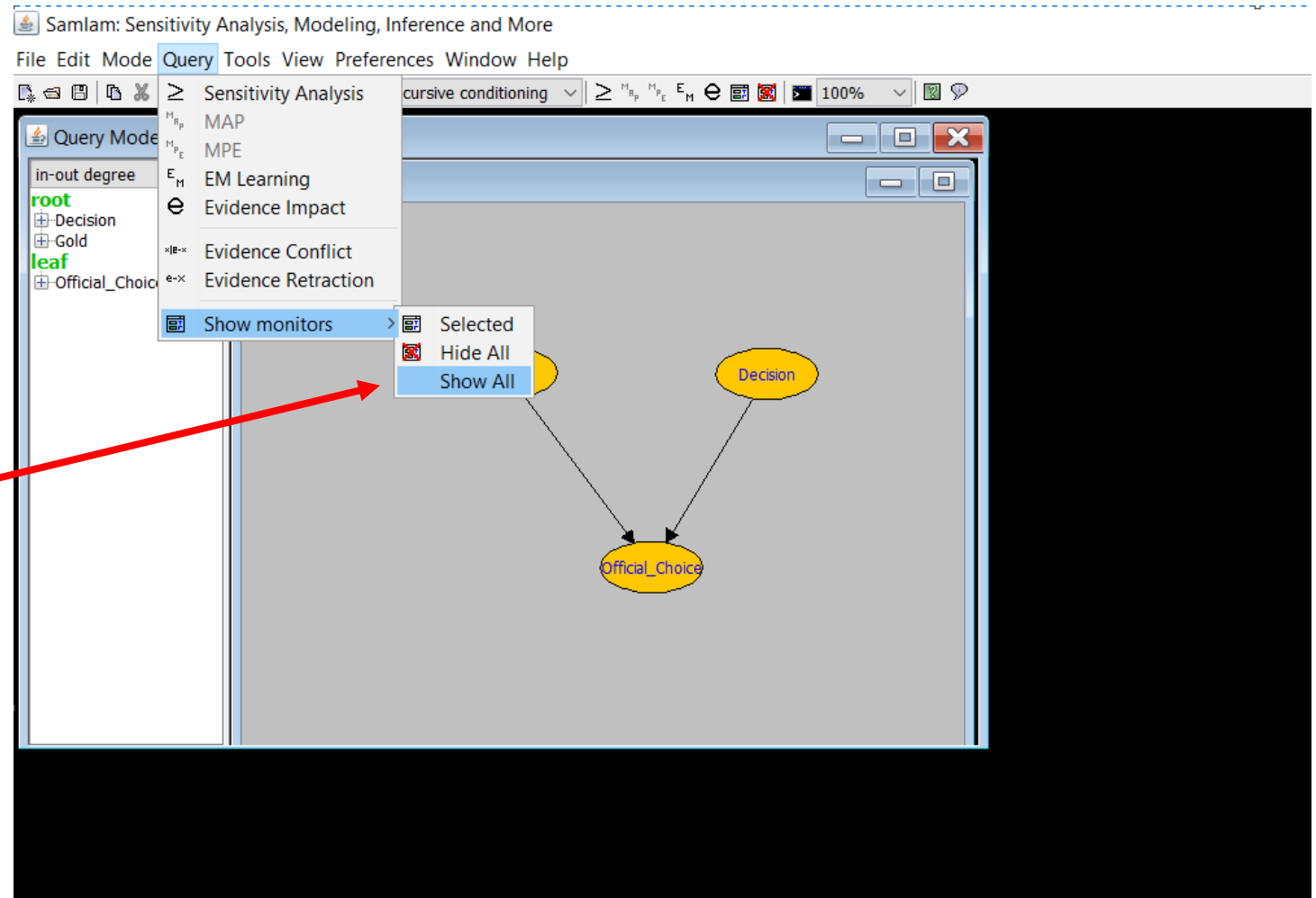
In this mode you can see the posterior probabilities of every variable. To see it you can click on Query -> Show monitors -> Show All.



Samlam Introduction

- Now you can ask some query to the network:

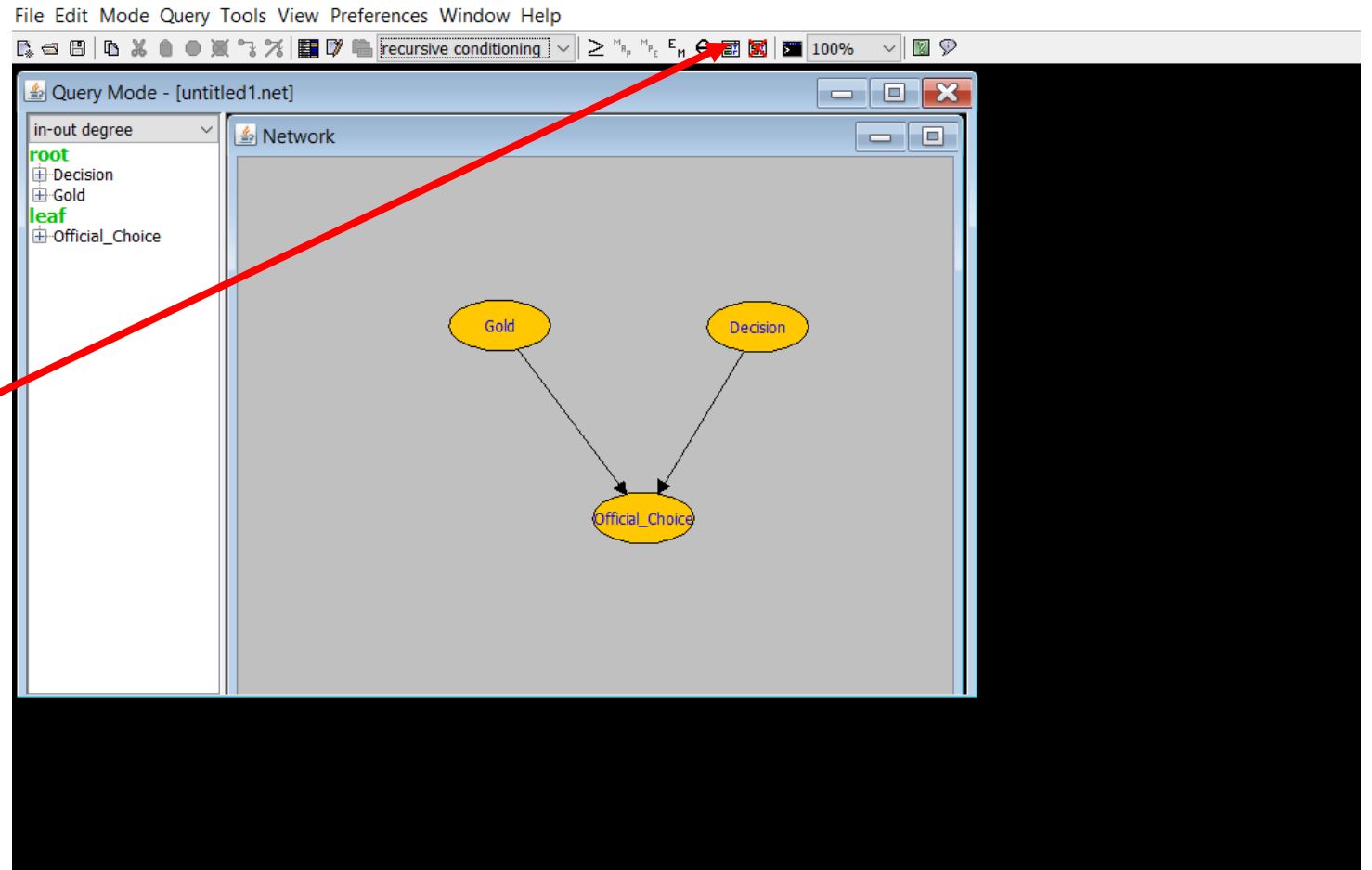
In this mode you can see the posterior probabilities of every variable. To see it you can click on Query -> Show monitors -> Show All



Samlam Introduction

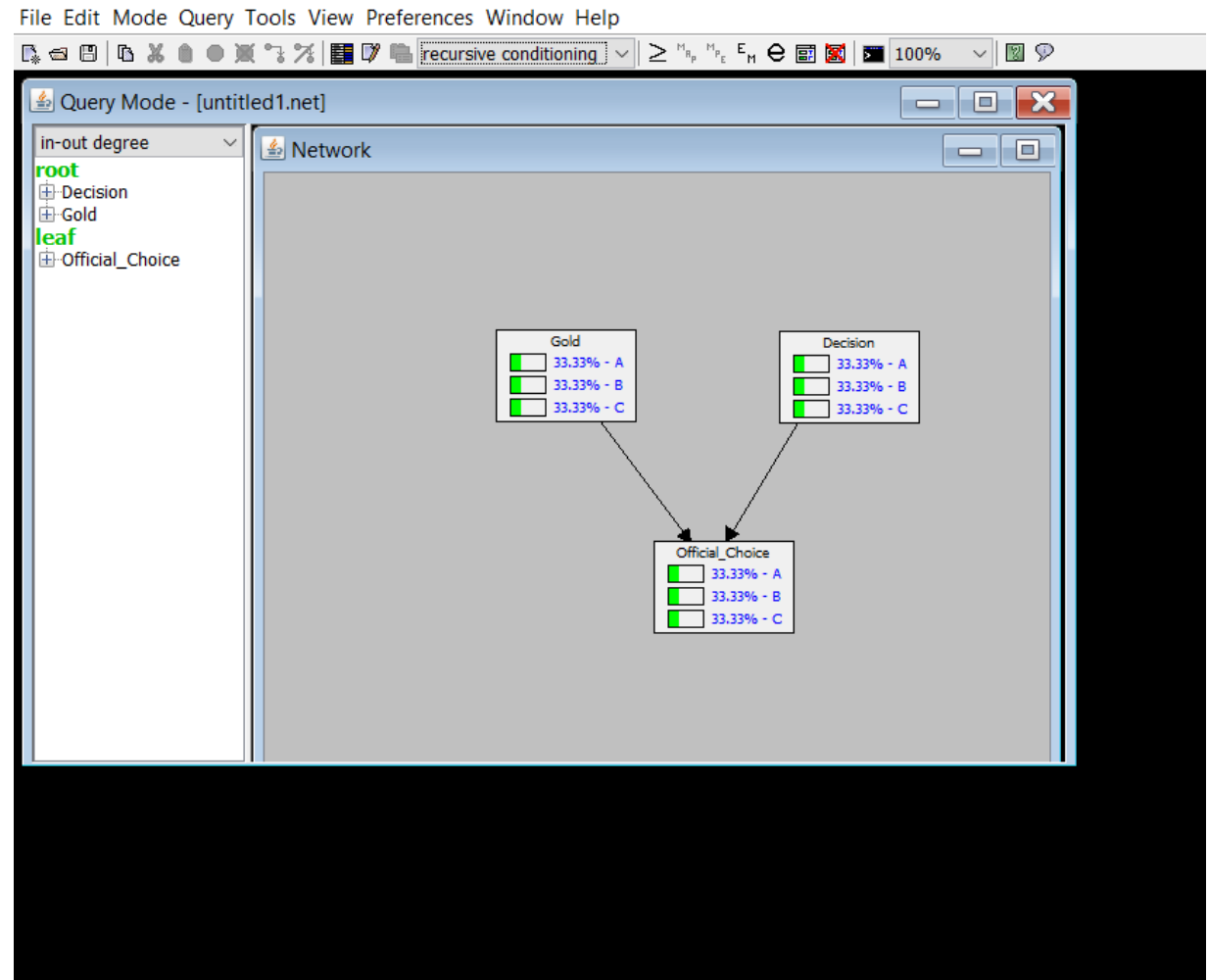
- Now you can ask some query to the network:

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



Samlam Introduction

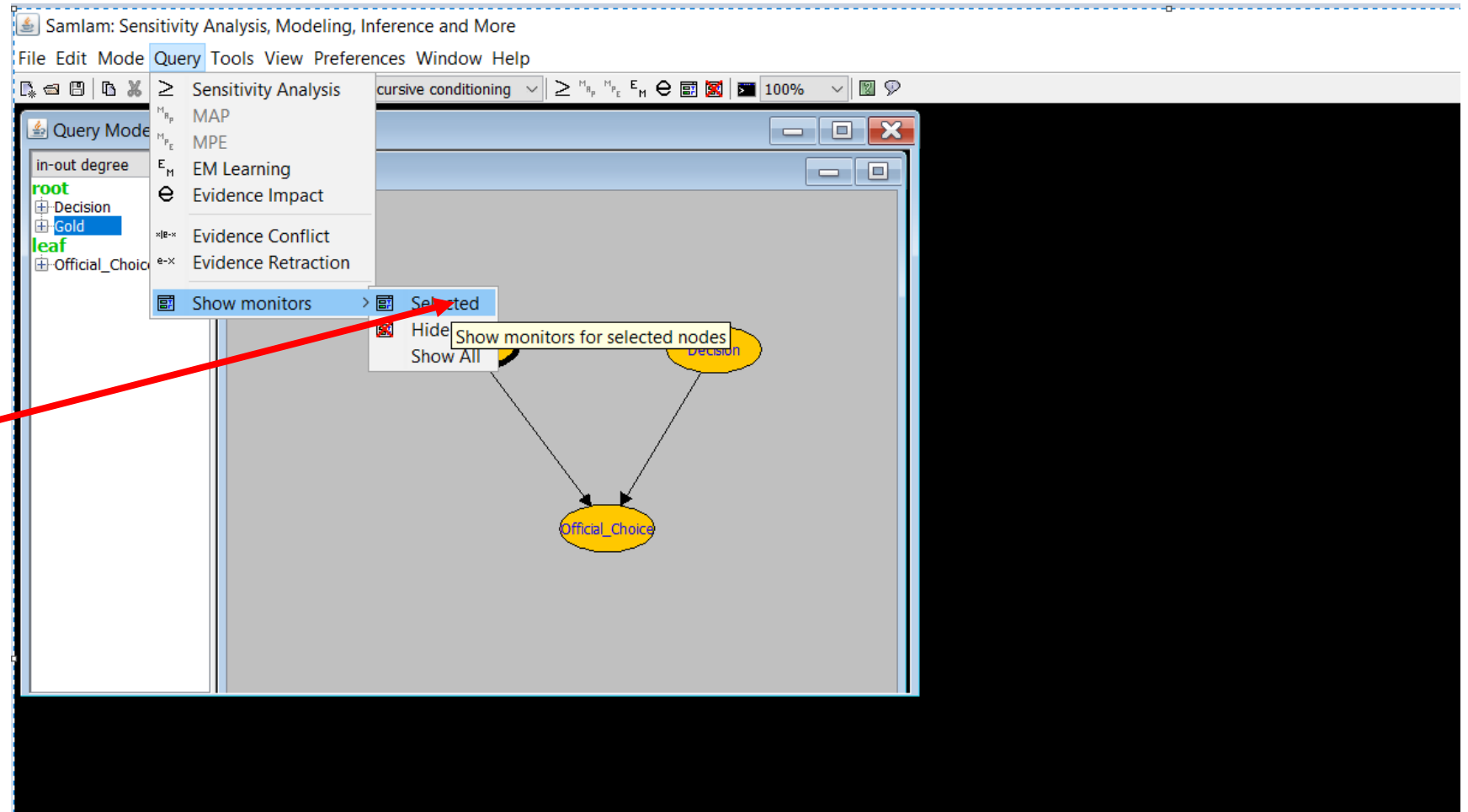
- Now you can ask some query to the network:



Samlam Introduction

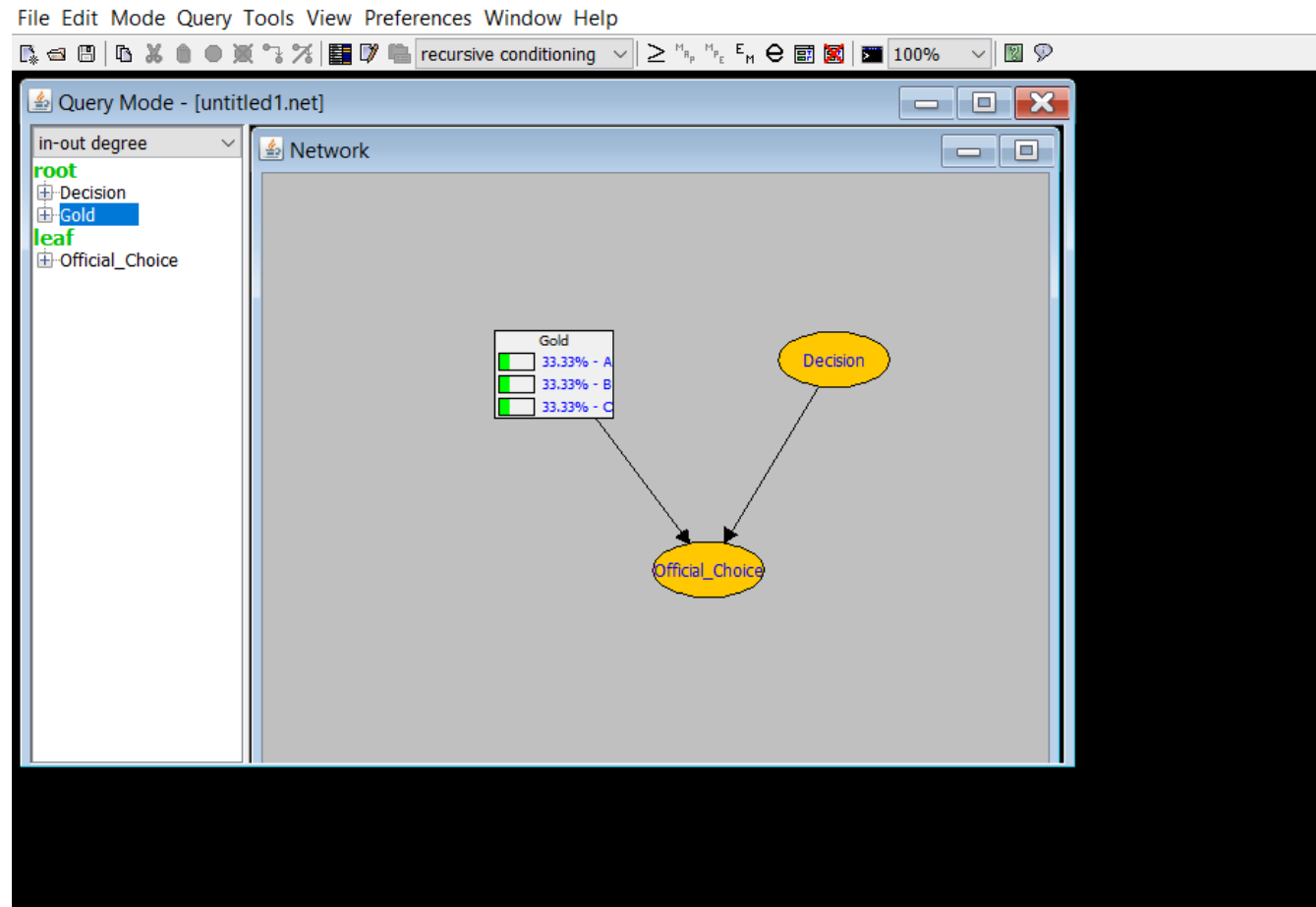
- Now you can ask some query to the network:

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 then click on «Selected»



Samlam Introduction

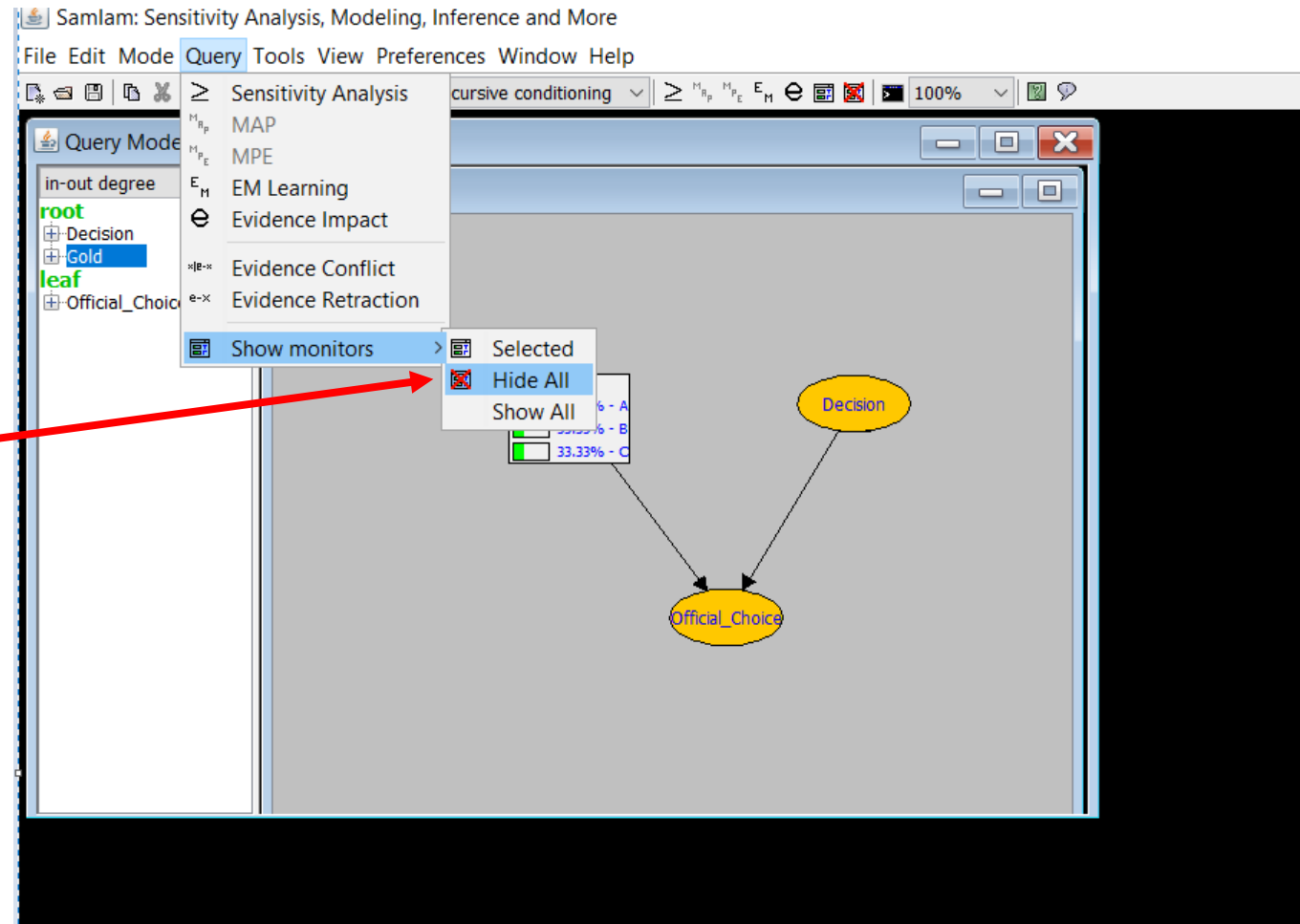
- Now you can ask some query to the network:



Samlam Introduction

- Now you can ask some query to the network:

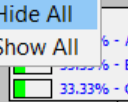
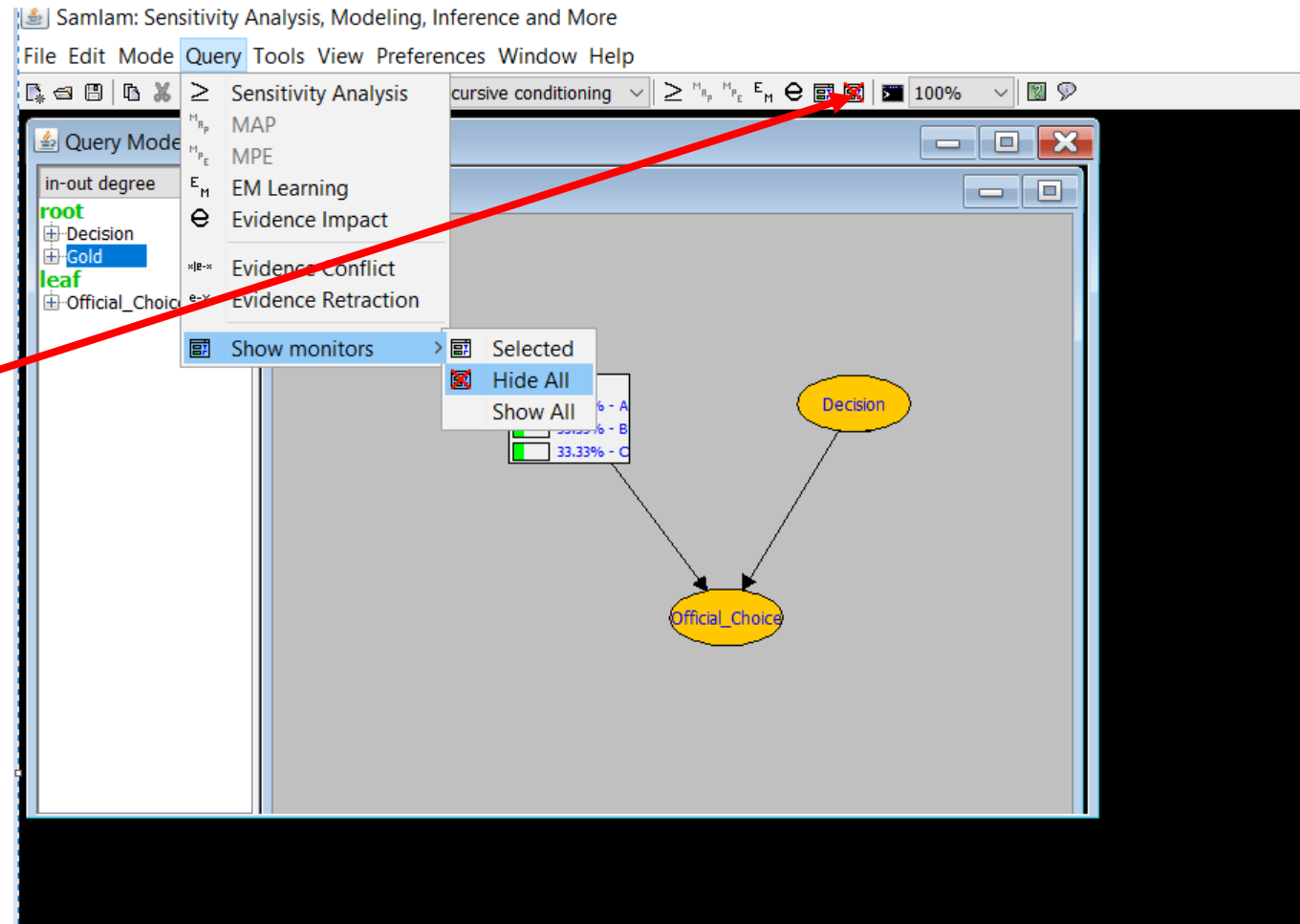
You can also
choose to hide all
the monitors.



Samlam Introduction

- Now you can ask some query to the network:

Also clicking this button

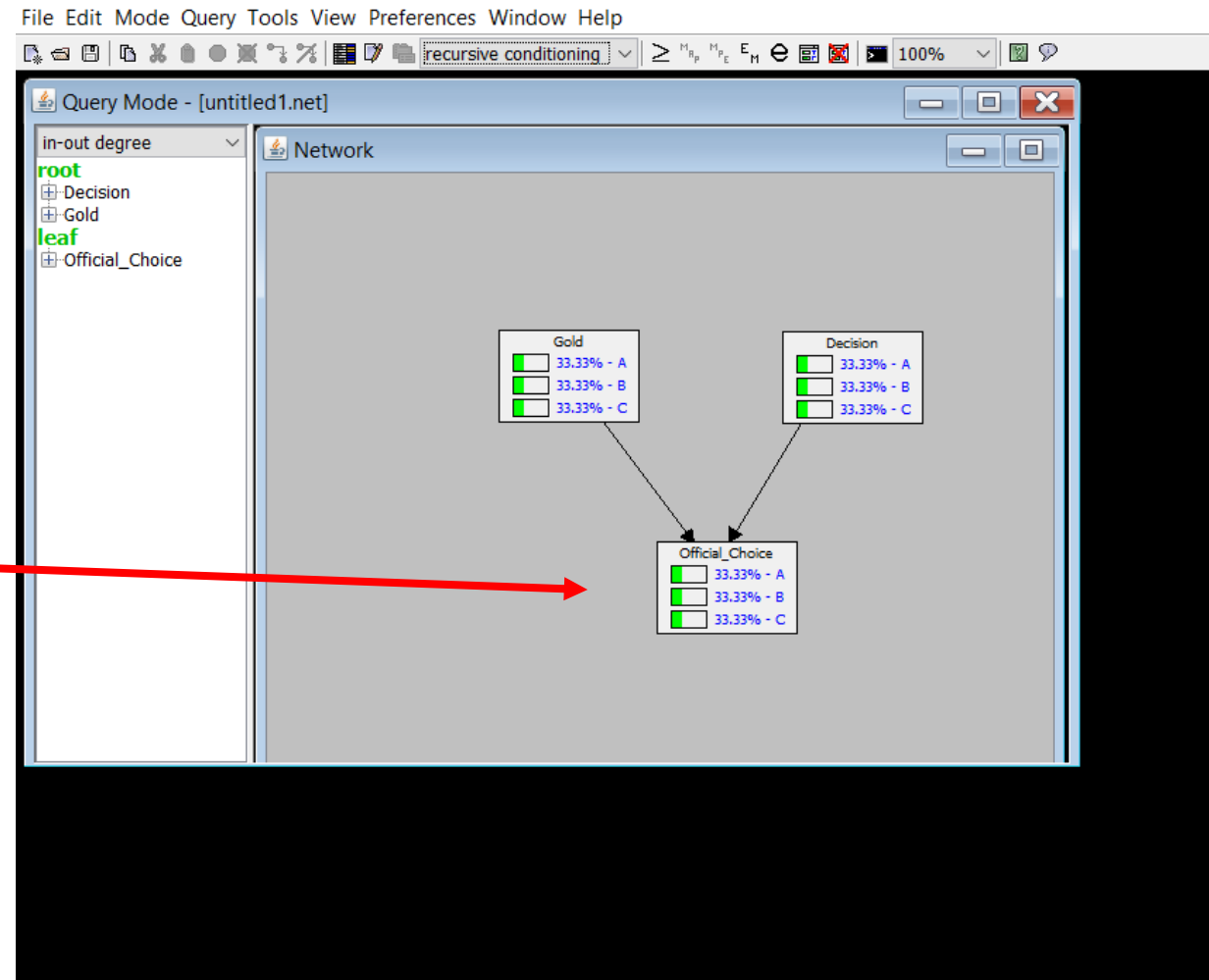


Samlam Introduction

- 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.

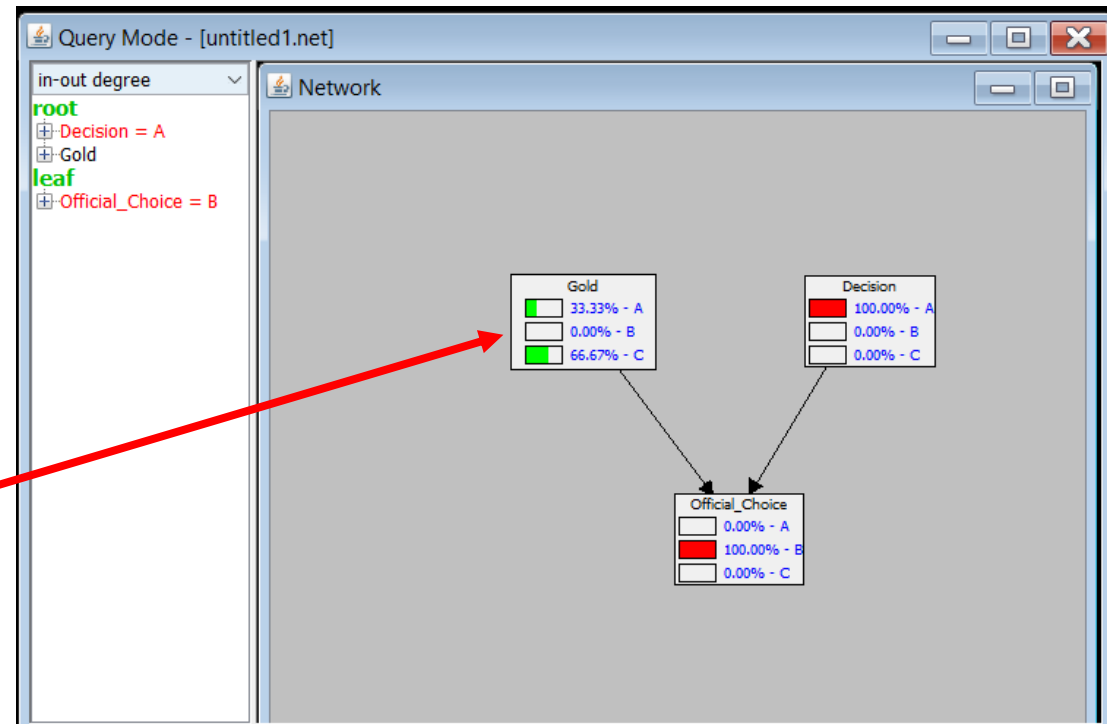
The network updates itself immediately.



Samlam Introduction

- Now you can ask some query to the network:

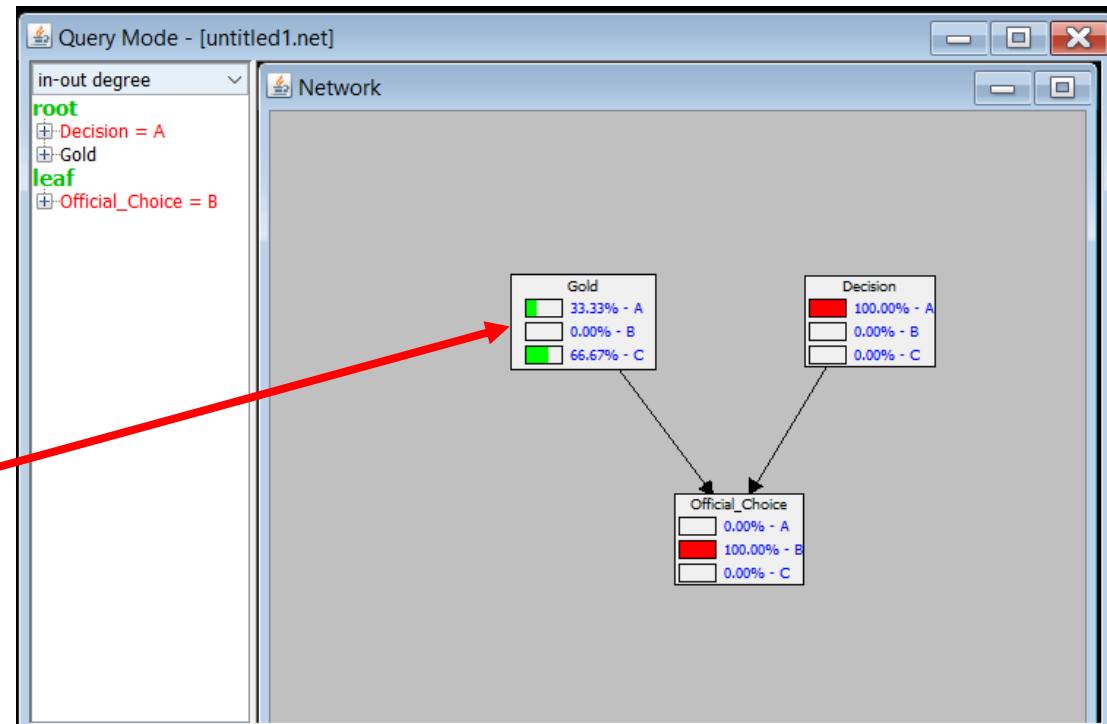
Now you can see in this monitor , for example, the answer of the query «If my initial decision was to choose the door A and the Official chose to open the door B, should I change my choice?»



Samlam Introduction

- Now you can ask some query to the network:

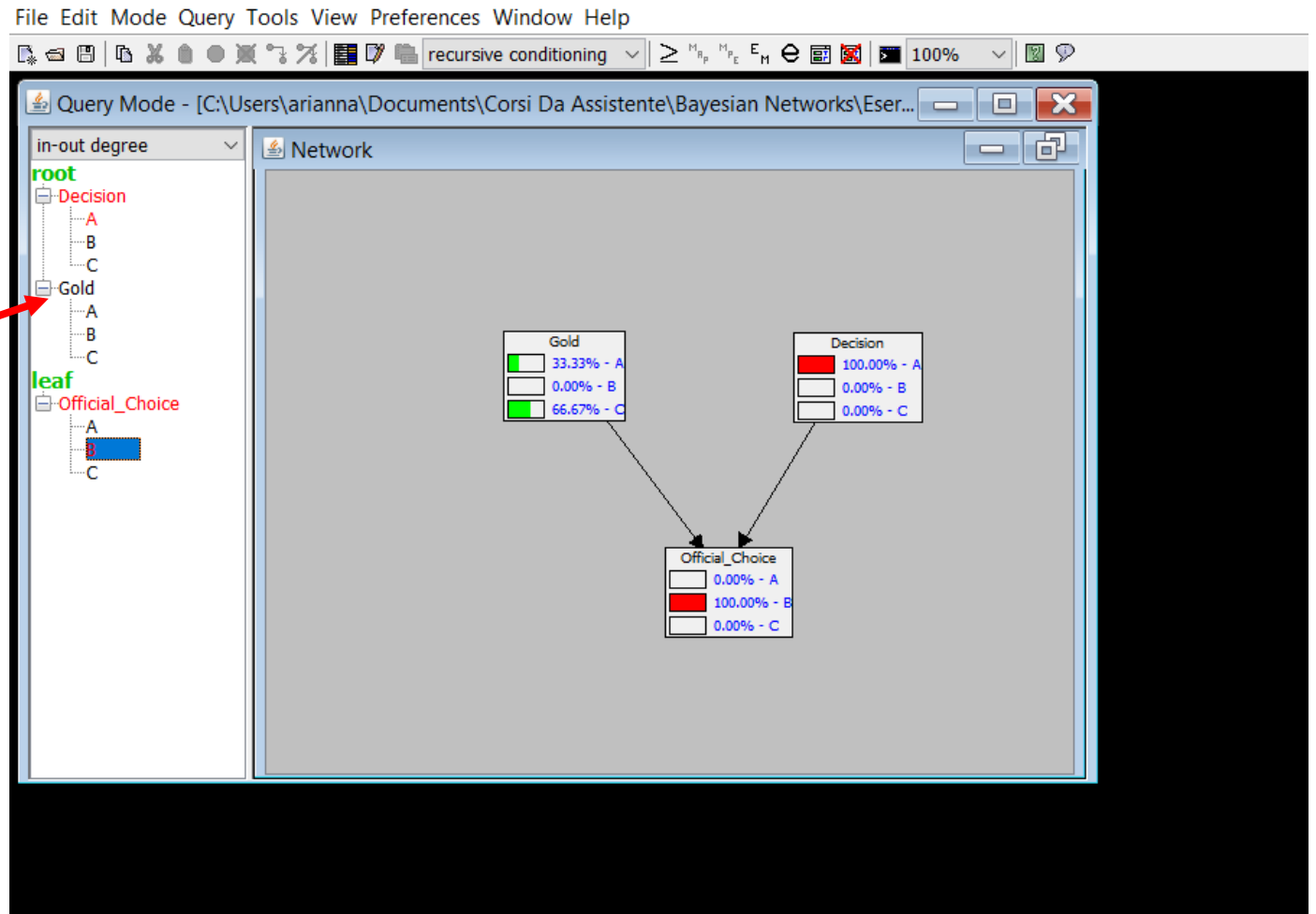
Yes!
Because the probability
(given the evidences in the
network) of finding the
prize behind the door C is
double respect to the
probability to find it
behind the initial door A!



Samlam Introduction

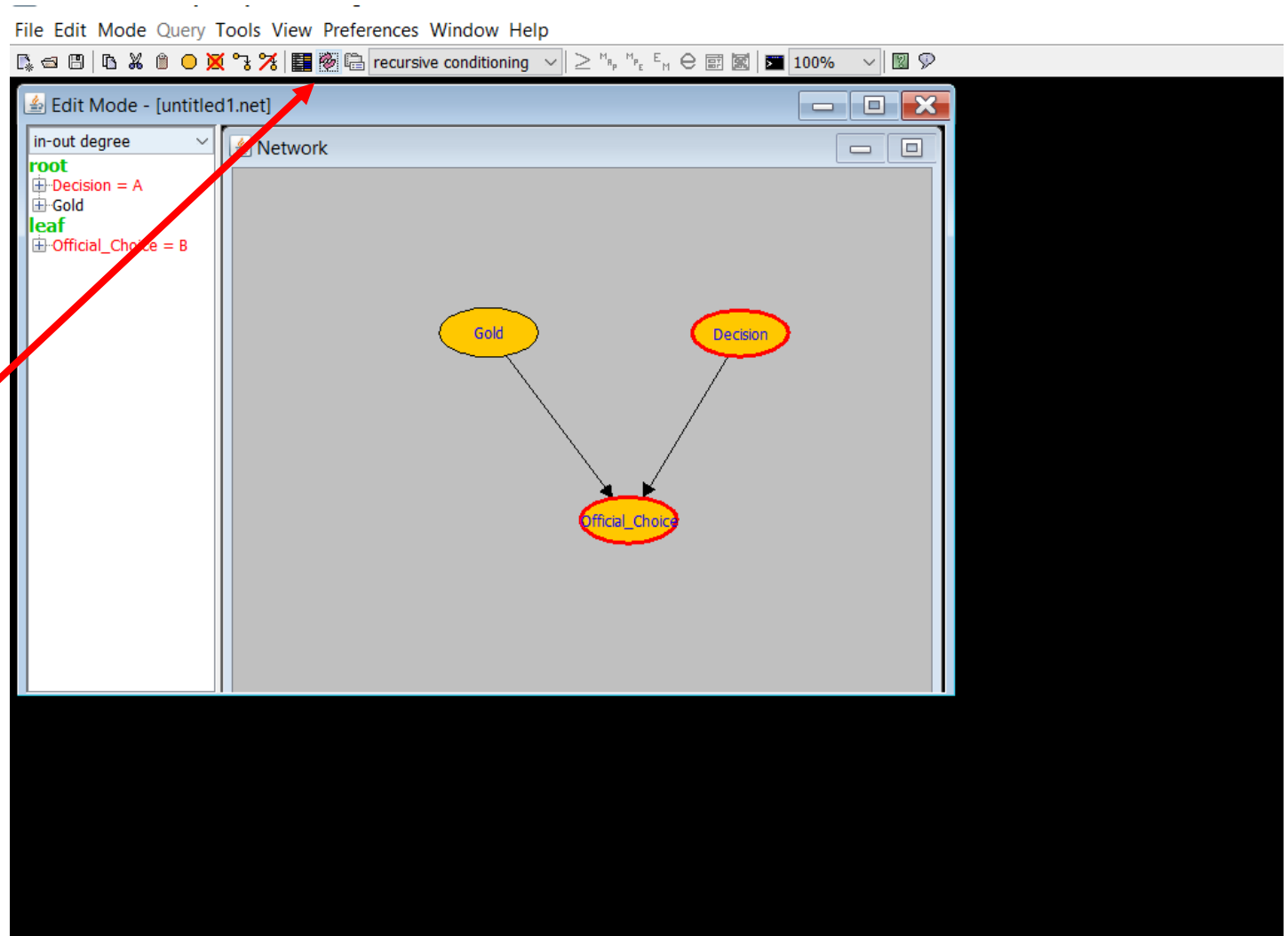
- Now you can ask some query to the network:

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.

