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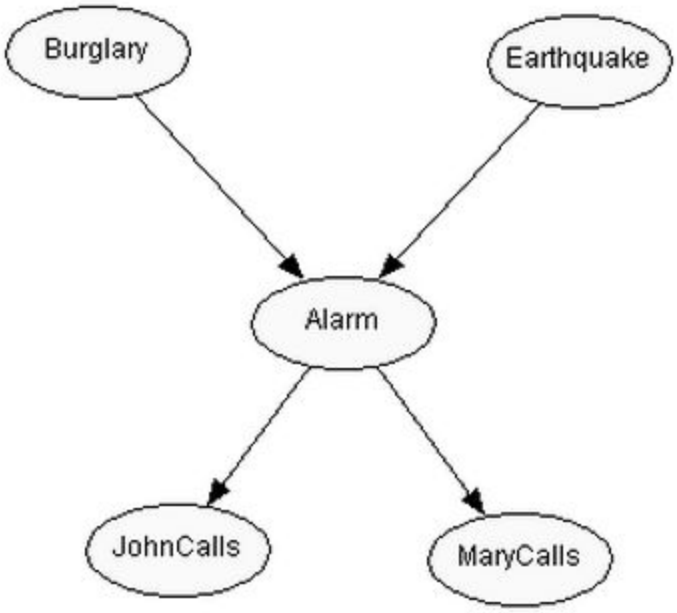
REPORT
(Implementing Bayesian Networks)

Nodes.



Problem definition: Our program is based on the probability that Burglary happened, Earthquake happened, Alarm rang depending on the 2 previous ones and that John called and Mary called if alarm rang or not :)

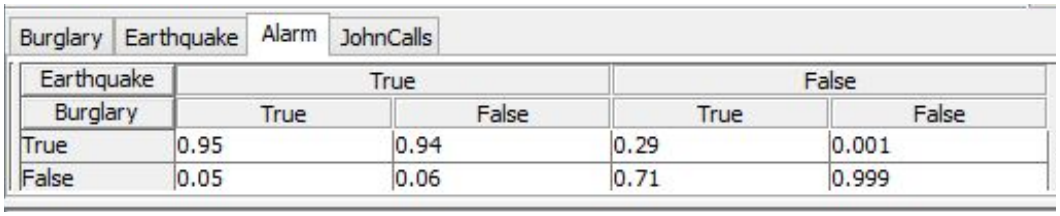
Hugin Lite.

- ★ Encode your example into the format that your program can read
- ★ Create a couple of queries
- ★ Run your program
- ★ Compare it to Hugin Lite to see that the values between both match.

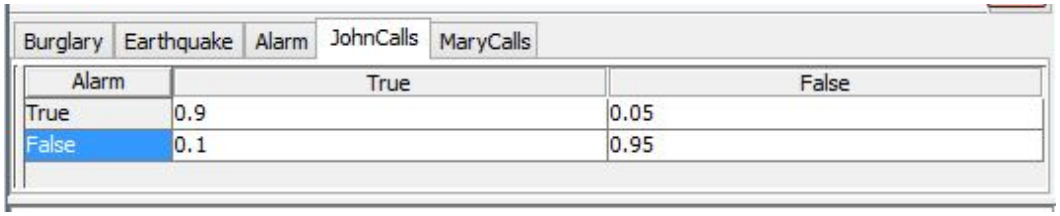
Values registered for Hugin are the below ones:

Burglary	Earthquake	Alarm	JohnCalls
True	0.002		
False	0.998		

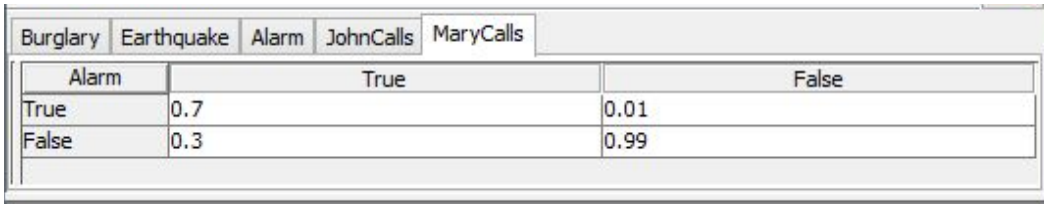
Burglary	Earthquake	Alarm	JohnCalls
True	0.001		
False	0.999		



Earthquake	True		False	
Burglary	True	False	True	False
True	0.95	0.94	0.29	0.001
False	0.05	0.06	0.71	0.999

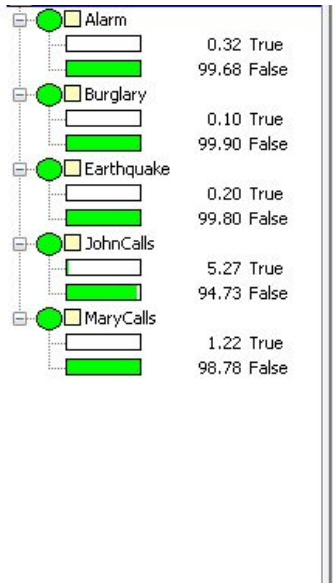


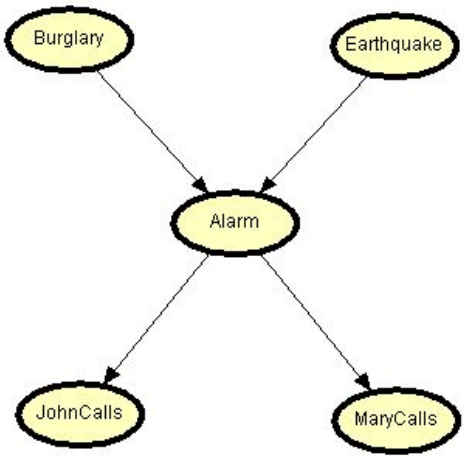
Alarm	True	False
True	0.9	0.05
False	0.1	0.95



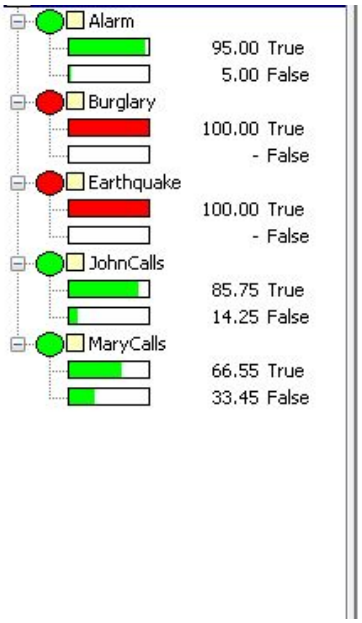
Alarm	True	False
True	0.7	0.01
False	0.3	0.99

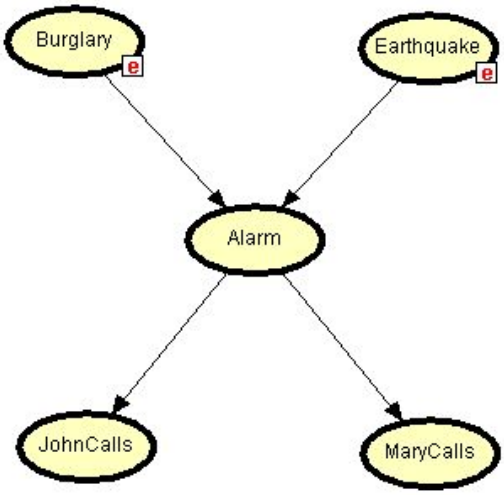
Finally compiling the previous tables as next image show, we can now decide the values for any node by clicking the, and we can visually see how it affects other nodes, and the probability that any previous node has been true or false.



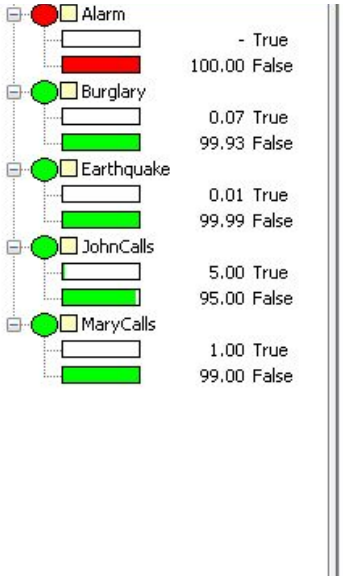


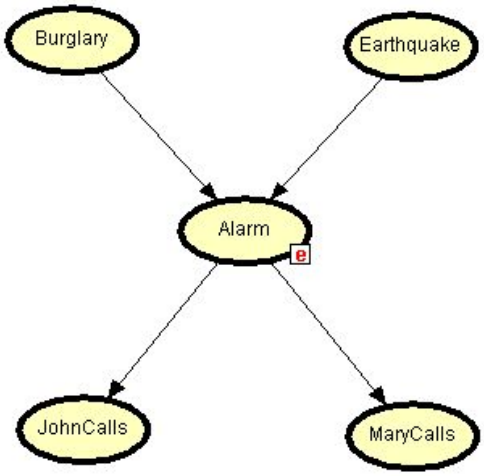
If we decide that Earthquake happened values change, deciding that an Earthquake happened but also that Burglary happened shows that the Alarm increases its probability to .95 to be true... so John Calls is 85.75 probability to be true, and Mary Calls is 66.55 probability to be true.



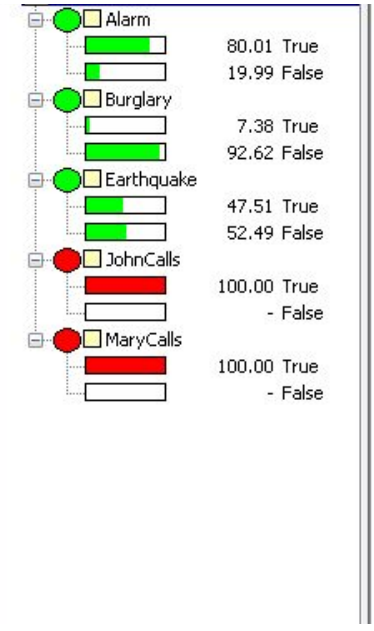


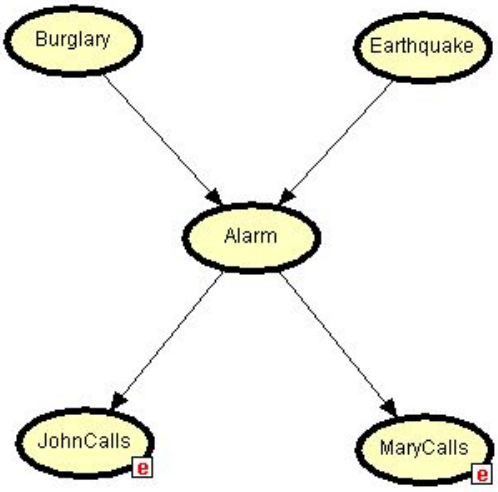
If alarm rang, what is the probability that Earthquake and Burglary happened? As we will see below, the probability is 0.07 for the Burglary to be true and 0.01 for the Earthquake.
And what is the probability if alarm rang to a) John calls to be false? b) And for Mary calls to be true? For a) the answer will be 95 probability and for b) 1 of probability.



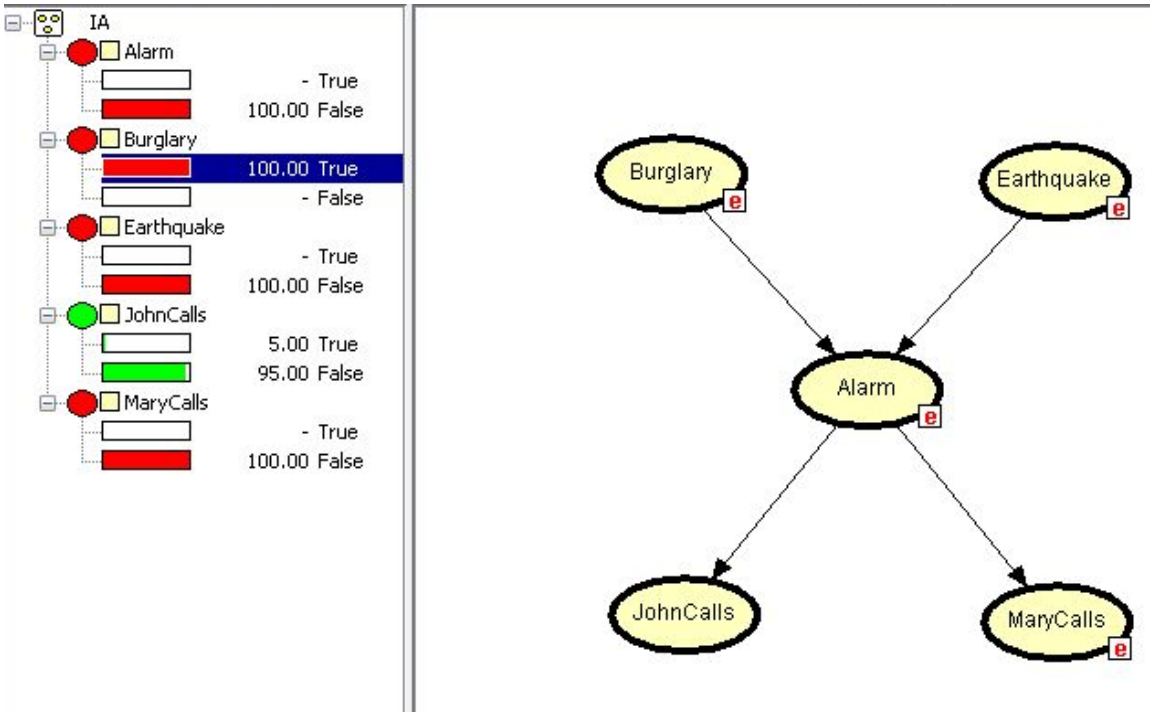


If Mary called and also John did, we can see bellow the probabilities that Alarm rang or not, and for that the probabilities that it has happened an earthquake or a Burglary for making the last nodes true.





For a last example we will compare our program to the hugin output. We are taking in account that ALARM didn't ring, and 'Earthquake':False , 'MaryCalls':False , 'Burglary':True. Hugin tell us that the probability of John called is:



And our output for the program is:

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{False: 0.95, True: 0.04999999999999996}
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Which coincides with the Hugin program :)

Hugin Lite allowed us not only to check our implementation and make a comparison, but see visually how probabilities affect some results. As Hugin Lite offers a GUI it was very simple to draw the nodes and to fill states for them, understanding how to use next was not that easy but it did not take a lot of time. As we know, Hugin Lite uses Bayesian network and so does we, the outputs were identical in terms of values only differing in the way they are displayed because Hugin Lite displayed them in percentages and we did in decimals but what they generate is basically the same.

We only tried Hugin lite, but Hugin has many products that are more complex and useful to people or business which deals with high risks and to make decisions not with doubts but with calculus and specific values with mathematics application. Advantages of using Bayesian network include that it combines expert knowledge and historical data handling missing values in data and computing with partial observations and Hugin tool allow us to have graphical models making very easy to communicate about probabilities and decisions in different circumstances.

Our program algorithm and the tool's have the same bases,the application of Bayesian network helps our program and the application Hugin to learn from data as more claims data and information become available, we think is the most important point because there are not only probabilities and maths involved but learning and that for sure is the key for achieving a goal in an efficient way. Of course they are more tools to use but we can say from what we know that Hugin is the simplest one with the lowest learning curve so may be used by many new users with not a high knowledge :)

Its incredible how Hugin lite can be used not only in classes but in real life, it has been used in right and probability area more specifically in cases where lots of nodes are required so for people that are not programer experts its really easy to compute probabilities using Bayesian network. With this kind of programs having exact values gives more credibility even to an attorney which wants to know how an action affects other, unfortunately the free trial of Hugin Lite version is limited to handle max. 50 states and learn from max. 500 cases.

Its also known that this tool (Hugin) helps discovering insight and provide a way to effectively combat fraud and risk, achieve compliance and reduce losses for a better bottom line, which can be needed not only for right and probability areas but any area that wants to combat risks and have exact values of fraud detection, credit default prediction and even identification of money laundering.