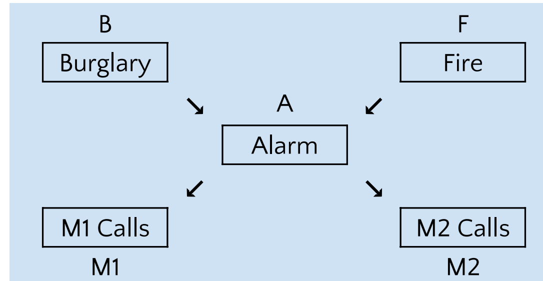
Calculating Conditional Probability of Events in a Bayesian Network

Question:

Find the probability that M1 is TRUE (M1 has called XYZ), M2 is TRUE (M2 has called XYZ) when the alarm 'A' rang, but no burglary 'B' and fire 'F' has occurred.

i.e Find the probability => P (M1, M2, A, ~B, ~F)

M1, M2 & A are TRUE events and ~B & ~F are FALSE events



Let, the following observed values are given:

Burglary B:

P (B=T) = 0.001 ('B' is TRUE i.e burglary has occurred)

P (B=F) = 0.999 ('B' is FALSE i.e burglary has not occurred)

Fire F:

P (F=T) = 0.002 ('F' is TRUE i.e fire has occurred)

P (F=F) = 0.998 ('F' is FALSE i.e fire has not occurred)

Alarm A		$P(A \mid B,E)$	
B	**F**	**P (A=T)**	**P (A=F)**
T	T	0.95	0.05
T	F	0.94	0.06
F	T	0.29	0.71
F	F	0.001	**0.999**

Alarm A node can be TRUE or FALSE (i.e may have rung or may not have rung). It has two parent nodes burglary B and fire F which can be TRUE or FALSE i.e it may have occurred or may not have occurred depending upon diff. conditions.

Person M1	$P(M1 \mid A)$	
A	**P (M1=T)**	**P (M1=F)**
T	**0.95**	0.05
F	0.05	0.95

Person M1 node can be TRUE or FALSE (i.e may have called person XYZ or not). It has a parent node, the alarm A, which can be TRUE or FALSE; That is it may have rung or may not have rung, upon burglary B or fire F.

Person M2	$P(M2 \mid A)$	
A	**P (M2=T)**	**P (M2=F)**
T	**0.8**	0.2
F	0.01	0.99

Person M2 node can be TRUE or FALSE (i.e may have called person XYZ or not). It has a parent node, the alarm A, which can be TRUE or FALSE; That is it may have rung or may not have rung, upon burglary B or fire F.

Solution:

To find P (M1, M2, A, ~B, ~F)

We need to calculate the probability of M1; we need to find it with regard to its parent node – alarm A.

To get the probability of M2; we need to find it with regard to its parent node — alarm A.

We find the probability of alarm A node with regard to ~B and ~F since burglary B and fire F are parent nodes of alarm A.

From the above observed probabilistic scan, we can P(M1, M2, A, ~B, ~F)

= P (M1/A) * P (M2/A) * P (A/~B~F) * P (~B) * P (~F)

= 0.95 * 0.8 * 0.001 * 0.999 * 0.998

= 0.00075