You have 2 neighbors, John and Mary, who call when the alarm goes off

A	P(J)
t	.90
f	.05

P(j|a)

Prob. john calls
given alarm
gone off T and
F

A	P(M)
t	.70
f	.01
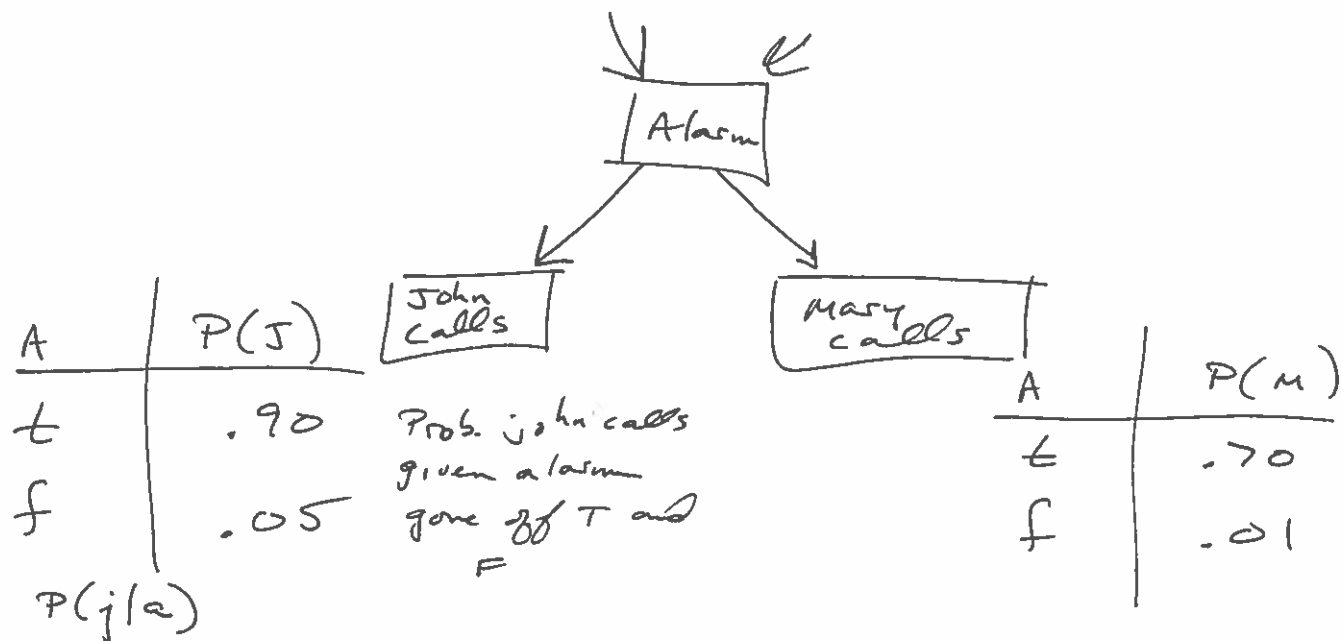
the pr of John calling influenced only by Alarm. We don't include P(B) because that is captured in $P(a \mid b)$ or $P(a \mid e)$

Inference

$$P(a \mid j) = \frac{P(j \mid a) P(a)}{P(j)}$$

Need $P(j) = \sum_a P(j,a)$

$P(j) = P(j \mid a) P(a) + P(j \mid \neg a) P(\neg a)$

$$P(j) = (.90 \times .0025) + (.05 \times .9975)$$
$$= .0521$$

$$P(a|j) = \frac{.90 \times .0025}{.0521} \approx .0432$$

More complicated

$P(b|j)$ — prob of burglary given J called.

$$P(b|j) = \frac{P(j|b)P(b)}{P(j)}$$

$$P(j|b) = \frac{\sum\limits_{a} \sum\limits_{e} P(j, b, a, e)}{\sum\limits_{a} \sum\limits_{e} P(b, a, e)} \quad \begin{array}{l}\text{These given}\\\text{as conditional}\\P(a|b,e)...\end{array}$$

$$P(a|b) = \frac{P(a,b)}{P(b)}$$

b in this case is actually burgl, alarm, earth Mary called not included. She has no influence on outcome.

~~the~~ rows in summation:
$$(.90 \times .95 \times .001 \times .002)$$
$$j=T, \ a=T, \ b=T, \ e=T$$
$$e=F$$
$$b=F, \ e=T$$

$P(j|b) = .849$

Pr. that john called given a burglary.

$$P(b|j) = \frac{P(j|b)\,P(b)}{P(j)}$$

$$= \frac{.849 \times .001}{.0521} = .0163$$

$$P(s|c,p) = \frac{P(s,c,p)}{P(c,p)}$$

$$= \frac{P(c|s,p)P(s)P(p)}{P(c|s,p)P(s)P(p) + P(c|\neg s,p)P(\neg s)P(p)}$$

$$= \frac{(.05 \times .30 \times .10)}{(.05 \times .30 \times .10) + (.02 \times .70 \times .10)}$$

$= .51$ high pollution explains away ~~smoking as cause of cancer~~ smoking as cause of cancer.