P(B)
.001

Burglary

P(E)
.002

Earthquake

B	E	P(A|B,E)
T	T	.95
T	F	.94
F	T	.29
F	F	.001

Alarm

JohnCalls

A	P(J|A)
T	.90
F	.05

MaryCalls

A	P(M|A)
T	.70
F	.01

WHAT IS $P(A|B,E)$?

WTF: $P(A | B=T, E=T)$

BY INSPECTION, $P(A|B,E) = \boxed{0.95}$

WHAT IS $P(A|B)$?

E IS HIDDEN. Σ OVER E

$$P(A|B) = \frac{P(A,B)}{P(B)}$$

$P(A,B) = P(A|B) \cdot P(B)$ BY CHAIN RULE

DON'T HAVE JUST $P(A,B)$ IN OUR TABLES

$P(A,B) = \sum_e P(A|B,E) \cdot P(E) \cdot P(B)$

FROM WED: $P(A,B) = \sum_c P(A,B|c) \cdot P(c)$

$\therefore P(A,B) = P(A | B=T, E=T, F) \cdot P(E=T,F) \cdot$
$P(B=T)$

$$= P(A \mid B=T, E=T) \cdot P(E=T) \cdot P(B=T)$$

$$+ P(A \mid B=T, E=F) \cdot P(E=F) \cdot P(B=T)$$

$$= \quad 0.95 \times 0.001 \times 0.002$$

$$+ \ 0.94 \times 0.001 \times (1-0.002) \quad = \ 0.00094002$$

BUT WE WANT $P(A \mid B) = \dfrac{P(A,B)}{P(B)}$

$$= \frac{0.00094002}{0.001} \quad = \quad \boxed{0.94002}$$

CALCULATE! $P(E \mid A)$

$$P(E \mid A) = \frac{P(E,A)}{P(A)} = \frac{P(A,E)}{P(A)}$$

PROM CLASS!

$$P(A) = \sum_{e} \sum_{b} P(A \mid B, E) \cdot P(B) \cdot P(E)$$

$$= 0.0025$$

$$P(A,E) = \frac{\sum\limits_{b} P(A|B,E) \cdot P(B) \cdot P(E)}{P(A)}$$

$$= \frac{P(A|B=T,F, E=T) \cdot P(B=T,F) \cdot P(E=T)}{P(A)}$$

$$= \frac{\begin{aligned}&P(A|B=T, E=T) \cdot P(B=T) \cdot P(E=T) \\ &+ P(A|B=F, E=T) \cdot P(B=F) \cdot P(E=T)\end{aligned}}{P(A)}$$

$$= \frac{0.95 \times 0.001 \times 0.002 + 0.29 \times (1-0.001) \cdot (0.002)}{0.0025}$$

$$= \boxed{0.2318}$$