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Priors:

$P(B)$ [Burglary] $= 0.001$

$P(E)$ [Earthquake] $= 0.002$

Conditional Probability for alarm (A)

- $P(A|B,E) = 0.95$
- $P(A|B,-E) = 0.94$
- $P(A|-B,E) = 0.29$
- $P(A|-B,-E) = 0.001$

Conditional Probability for John Calling (J):

- $P(J|A) = 0.90$
- $P(J|-A) = 0.05$

Apple Baye's Rule

$$P(B|J) = \frac{P(J|B) \times P(B)}{P(J)}$$

Account for whether the alarm went off or not:

$$P(J|B) = [P(J|A) \times P(A|B)] + [P(J|-A) \times P(-A|B)]$$

$$P(A|B) = (0.95 \times 0.002) + (0.94 \times 0.998) = 0.94002$$

$$P(-A|B) = 1 - 0.94002 = 0.05998$$

$$P(J|B) = (0.90 \times 0.94002) + (0.05 \times 0.05998) = 0.849017$$

$P(J)$ = Normalization Constant

$$P(J) = P(J|A)P(A) + P(J|-A)P(-A)$$

$$P(A) = (0.95 \times 0.001 \times 0.002) + (0.94 \times 0.001 \times 0.998) + (0.29 \times 0.999 \times 0.002) + (0.001 \times 0.999 \times 0.998$$

$$P(A) = 0.002516$$

$$P(-A) = 1 - 0.002516 = 0.997484$$

$$P(J) = (0.90 \times 0.002516) + (0.05 \times 0.997484) = 0.0521$$

Finally...

$$P(B|J) = \frac{0.849017 \times 0.001}{0.0521} \approx 0.0163$$

Probability of a burglary given that John called is approximately 1.6 %