☑ Inspector Clouseau

$$\left.\begin{aligned} p(b) &= 0.6 \\ p(m) &= 0.2 \end{aligned}\right\}$$ priors, independent!

Table of conditionals: (& complements)

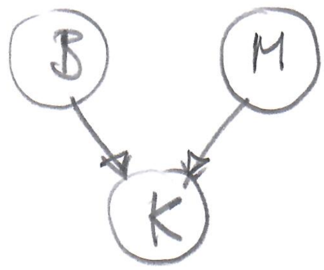
$p(k \mid \bar{b}, \bar{m}) = 0.3 \longrightarrow p(\bar{k} \mid \bar{b}, \bar{m}) = 1 - p(k \mid \bar{b}, \bar{m}) = 0.7$

$p(k \mid \bar{b}, m) = 0.2$

$p(k \mid b, \bar{m}) = 0.6$

$p(k \mid b, m) = 0.1$

DAG: Directed Acyclic Graph



"is murderer"

$\downarrow$

$dom(M) = \{m, \bar{m}\}$

$dom(B) = \{b, \bar{b}\}$

$dom(K) = \{k, \bar{k}\}$

$\Longrightarrow$ joint probability distribution

$$p(K, B, M) = p(K \wedge B \wedge M) = p(K \mid B, M) \cdot \underbrace{p(B) \cdot p(M)}_{\text{independent!}}$$

$\Longrightarrow$ 3D probability table

$8 = 2^3$ entries

<u>we look for:</u>

$$p(B=b \mid K=k) =$$
$$p(b \mid k) \quad = \; ?$$

no M $\longrightarrow$ need to marginalize m out (average out...)

marginalize $m \in dom(M)$

$$p(b \mid k) = \sum_m p(b, M \mid k)$$

$$= \sum_m \frac{p(b, M, k)}{p(k)} \qquad \text{(Bayes, Product Rule)}$$

$$= \frac{\sum_m p(k \mid b, M) \cdot p(b) \cdot p(M)}{\underbrace{\sum_m \sum_b p(k \mid B, M) \cdot p(B) \cdot p(M)}_{p(k)}}$$

$$= \frac{p(b) \cdot \sum_m p(k \mid b, M) \cdot p(M)}{\sum_{b \in dom(B)} p(B) \cdot \sum_{m \in dom(M)} p(M) \cdot p(k \mid B, M)}$$

☑ <u>Alternatively:</u>

$$p(b \mid k) = \sum_m p(b, M \mid k)$$

$$= \sum_m \frac{p(k \mid b, M)\, p(b)\, p(M)}{p(k)}$$

$$p(k) = \sum_{b \in B} \sum_{m \in M} p(k, b, m) \quad \Big\} \text{ "evidence"}$$