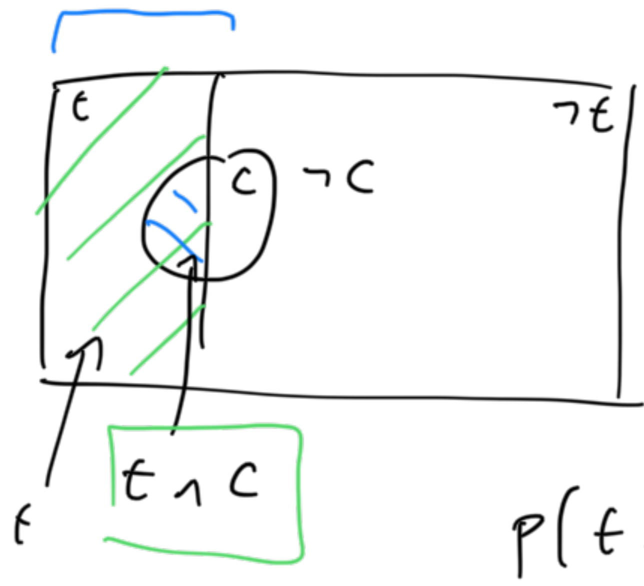
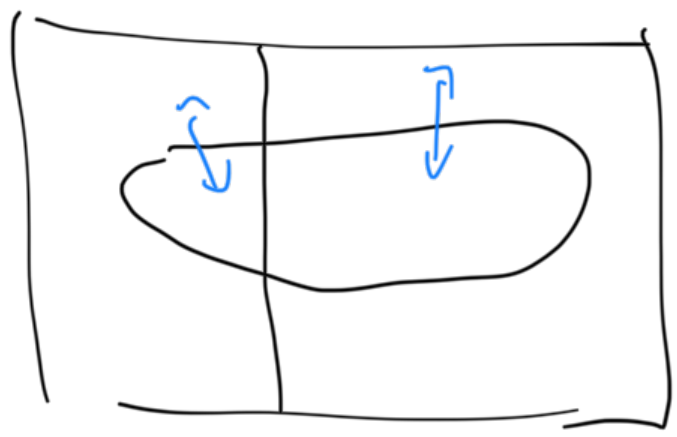
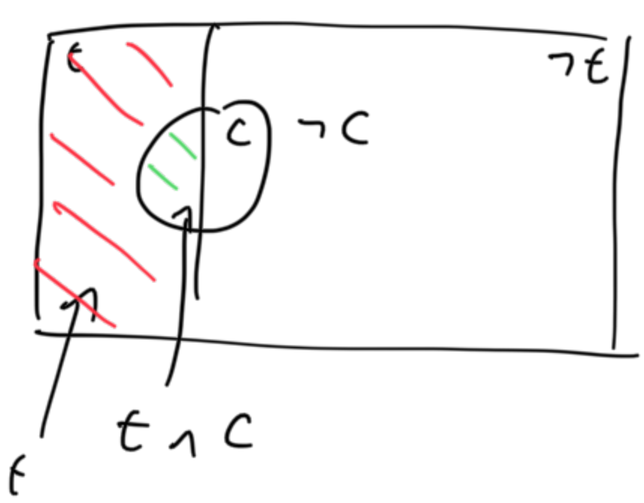
Slide 25



$$\frac{P(t \land c)}{P(t)}$$



$P(c \mid t) = P(c) = P(c \mid \neg t)$



Normalization: scale up left part to 1 by dividing red and green part by sum of red and green part

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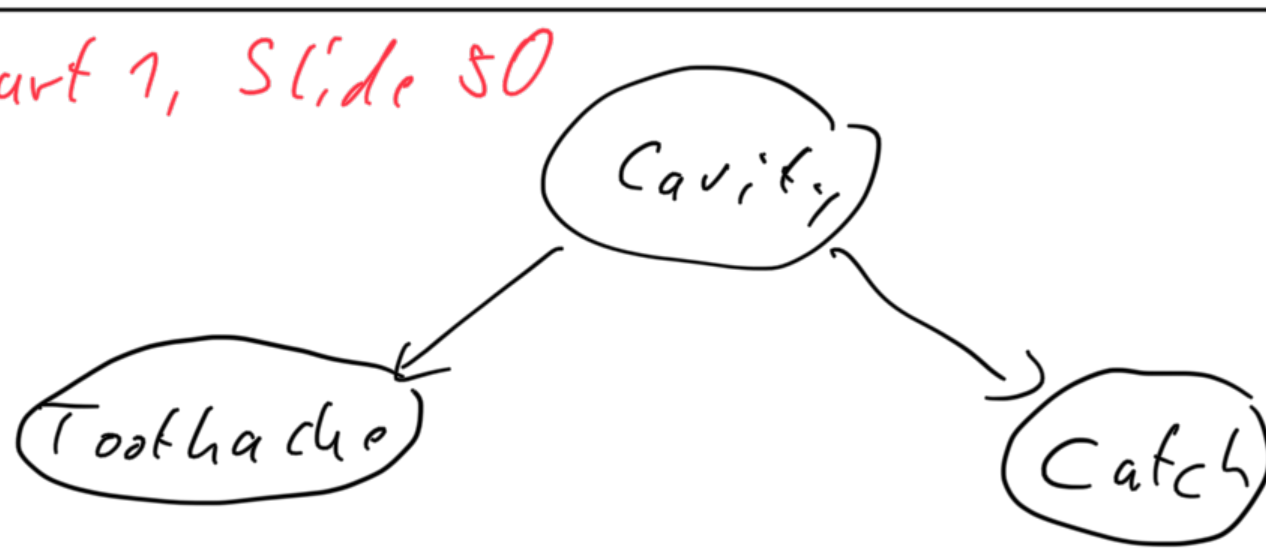
Part 1, Slide 50



Given toothache, catch, we want $P(Cavity \mid tootha., catch)$

Remaining vars: $\emptyset$

Norm. and Marg.

$P(Cavity \mid tootha., catch) = \alpha\, P(Cavity, tootha., catch)$

chain rule

x_1 = Cavity, x_2 = Tootache, x_3 = Catch

P(cavity, toota., catch) =
P(catch | tootha, Cavity) ·
P(toothache | cavity) ·
P(cavity)

Exploiting conditional independence

-> Instead of P(catch | toothache, cavity)
use P(catch | cavity)

P(cavity | toothache, catch) =
α P(catch | cavity) P(tootache | cavity) · P(cavity)

$\alpha \langle 0.9 \cdot 0.6 \cdot 0.2, \quad 0.2 \cdot 0.1 \cdot 0.8 \rangle =$

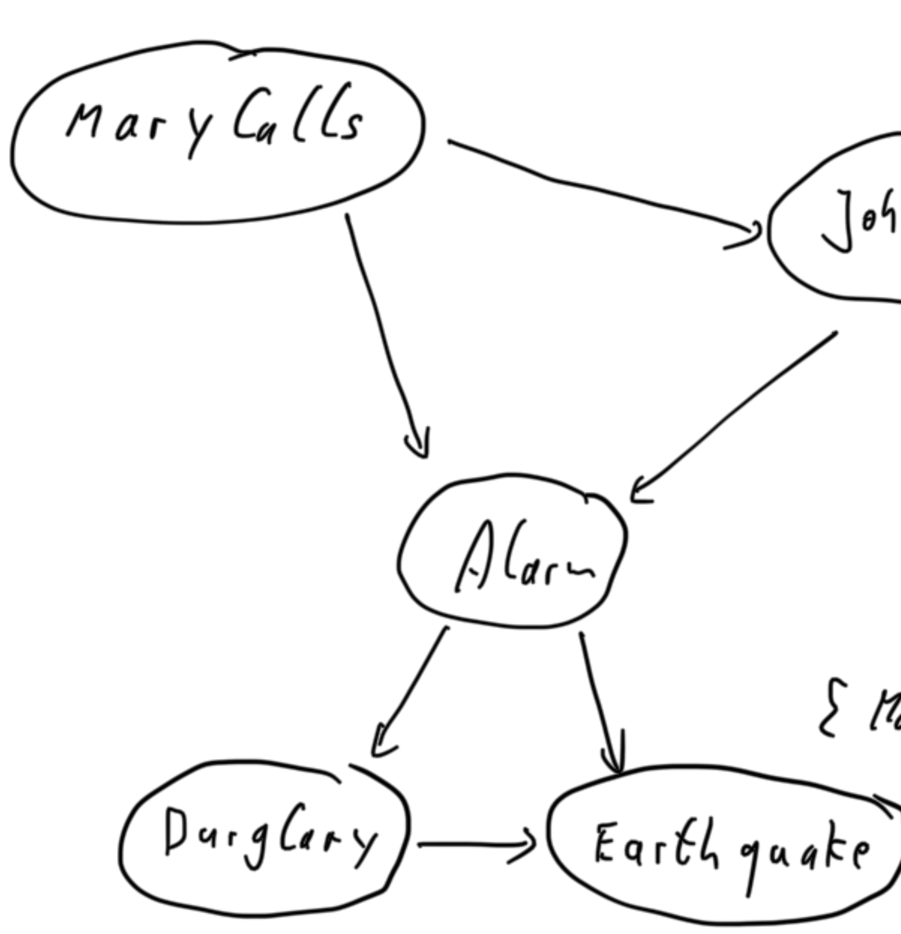
$\alpha \langle 0.108, \quad 0.016 \rangle \qquad \alpha = \dfrac{1}{0.108 + 0.016} = 8.06$

P(Cavity | toothache, catch) ≈ 0.87

Part 2, Slide 24/25

MaryCalls, JohnCalls, Alarm, Burglary, Earthquake

choose minimal set of Parents$(X_i) \subseteq \{X_1, .., X_{i-1}\}$ so that
$P(X_i \mid X_{i-1}, .., X_1) = P(X_i \mid \text{Parents}(X_i))$



{ }

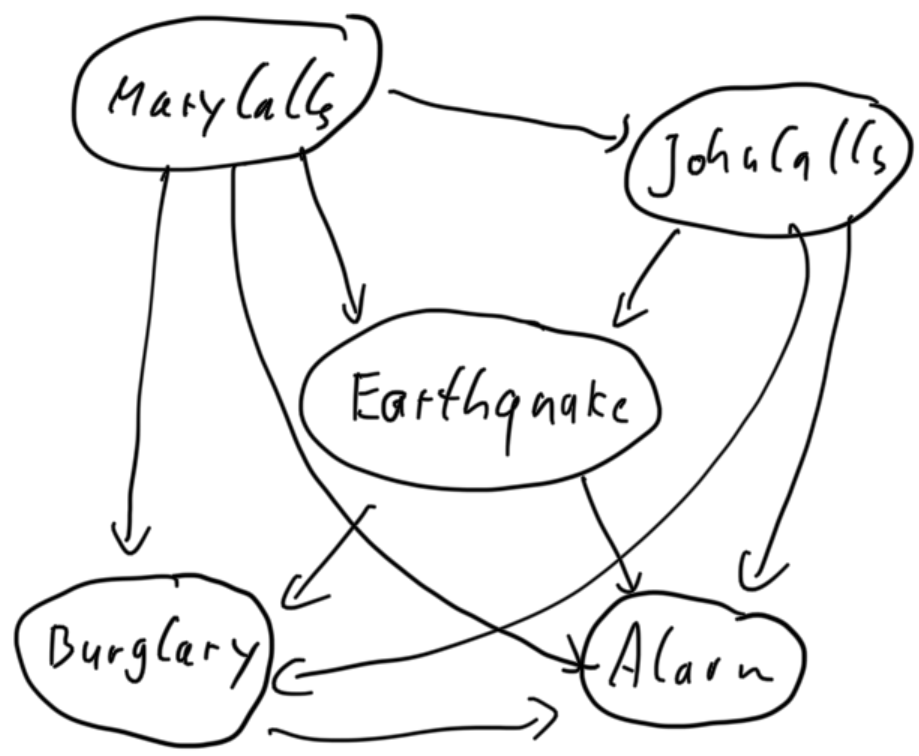
{MaryCalls}

{MaryCalls, JohnCalls}

{ MaryCalls, JohnCalls, Alarm}

{ MaryCalls, JohnCalls, Alarm, Burg.}

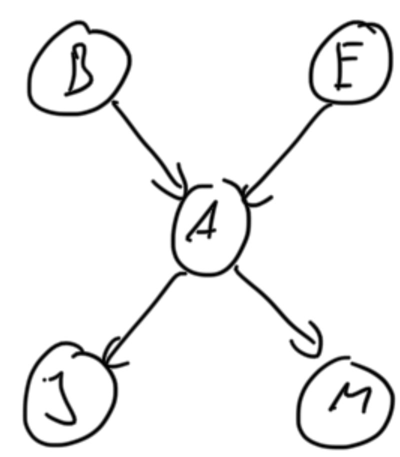
MaryCalls, JohnCalls, Earthquake, Burglary, Alarm



Part 2, Slide 33

want $P(Burglary \mid johnCalls, maryCalls)$

Hidden: $\{Earthquake, Alarm\}$



Norm. + Marg:

$$P(B \mid j, m) = \alpha\, P(B, j, m) =$$

$$\alpha \sum_{v_E} \sum_{v_A} P(B, j, m, v_E, v_A)$$

Ordering:

$X_1 = B \quad X_2 = E \quad X_3 = A \quad X_4 = J \quad X_5 = M$

$$P(B \mid j, m) = \alpha \sum_{v_E} \sum_{v_A} P(B) \cdot P(v_E) \cdot P(v_A \mid B, v_E) \cdot P(j \mid v_A) \cdot P(m \mid v_A)$$

$$P(B \mid j, m) = \alpha\, P(B) \sum_{v_E} P(v_E) \sum_{v_A} P(v_A \mid B, v_E) \cdot P(j \mid v_A) \cdot P(m \mid v_A)$$