Cavity	v	¬v
Toothache	t	¬t
Catch	h	¬h
Weather	warm	cold

P(v)
0.002

Cavity

Toothache

Catch

Cavity	P(t)
v	0.9
¬v	0.03

Cavity	P(h)
v	0.95
¬v	0.02

P(t ∧ v ∧ h)+ P(t ∧ v ∧ ¬h)
$= P(t \mid v) * P(v) * P(h \mid v) + P(t \mid v) * P(v) * P(\neg h \mid v)$
$= P(t \mid v) * P(v) * (P(h \mid v) + P(\neg h \mid v))$
$= P(t \mid v) * P(v) * (0.95 + 0.05)$
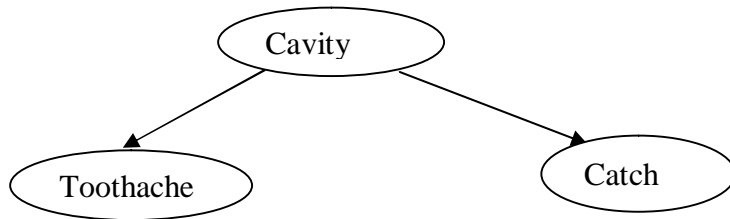**$= P(t \mid v) * P(v) * 1$**
$= 0.9 * 0.002$
$= 0.0018$
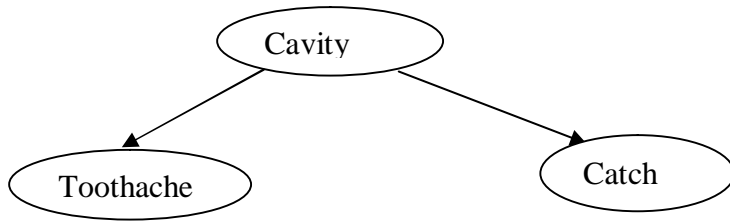
$P(x_1 \wedge x_2 \wedge \ldots \wedge x_n) = P((X_1 = x_1) \wedge (X_2 = x_2) \wedge \ldots \wedge (X_n = x_n))$
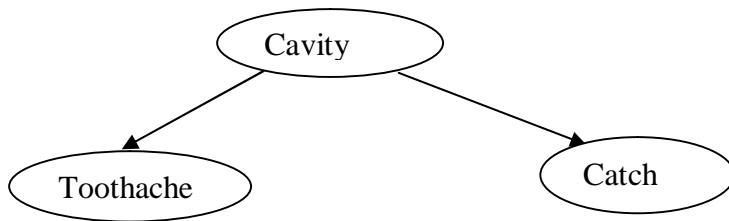
$= P(x_1, x_2, \ldots, x_n) = \prod_{i=1:n} P(x_i \mid parents(X_i)),$

where $parents(X_i)$ means specific values of $Parents(X_i)$

$[\ P(t \wedge v \wedge h) = P(t \mid v) * P(v) * P(h \mid v)\ ]$

$P(t \vee v) = P(t) + P(v)$

$= [\, P(t \wedge v \wedge h) + P(t \wedge v \wedge \neg h) + P(t \wedge \neg v \wedge h) + P(t \wedge \neg v \wedge \neg h) \,] + [\, \cancel{P(t \wedge v \wedge h)} + P(\neg t \wedge v \wedge h) + \cancel{P(t \wedge v \wedge \neg h)} + P(\neg t \wedge v \wedge \neg h) \,]$

$= [P(t \wedge v \wedge h) + P(t \wedge v \wedge \neg h)] + [P(t \wedge \neg v \wedge h) + P(t \wedge \neg v \wedge \neg h)] + [P(\neg t \wedge v \wedge h) + P(\neg t \wedge v \wedge \neg h)]$ **[Avoiding duplicate atomic events and paring for h/$\neg$h]**

$= P(t \mid v) * P(v) + P(t \mid \neg v) * P(\neg v) + P(\neg t \mid v) * P(v)$

$= P(t \mid v) * P(v) + P(\neg t \mid v) * P(v) + P(t \mid \neg v) * P(\neg v)$

$= P(v) * (P(t \mid v) + P(\neg t \mid v)) + P(t \mid \neg v) * P(\neg v)$

$= P(v) + P(t \mid \neg v) * P(\neg v)$

$= \text{Value}_{P(t \vee v)}$

$= \mathbf{V}$

Cavity → Toothache, Catch

$P(h \mid (t \vee v)) = P(h \wedge (t \vee v)) / P(t \vee v)$

$= P((h \wedge t) \vee (h \wedge v)) / \mathbf{V}$

$= (P(h \wedge t) + P(h \wedge v)) / \mathbf{V}$

$= (P(h \wedge t \wedge v) + P(h \wedge t \wedge \neg v) + \cancel{P(h \wedge v \wedge t)} + P(h \wedge v \wedge \neg t)) / \mathbf{V}$

$= (P(t \mid v) * P(h \mid v) * P(v) + P(t \mid \neg v) * P(h \mid \neg v) * P(\neg v)) + P(\neg t \mid v) * P(h \mid v) * P(v) / \mathbf{V}$

$= (P(t \mid v) * P(h \mid v) * P(v) + P(\neg t \mid v) * P(h \mid v) * P(v) + P(t \mid \neg v) * P(h \mid \neg v) * P(\neg v)) / \mathbf{V}$

$= (P(h \mid v) * P(v) * [P(t \mid v) + P(\neg t \mid v)] + P(t \mid \neg v) * P(h \mid \neg v) * P(\neg v)) / \mathbf{V}$

$= (P(h \mid v) * P(v) + P(t \mid \neg v) * P(h \mid \neg v) * P(\neg v)) / \mathbf{V}$