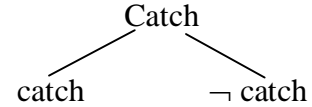
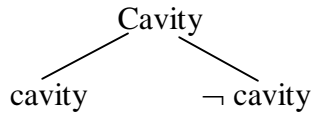
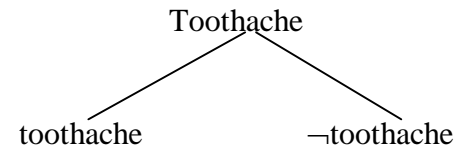


| | toothache | | ¬toothache | |
|---------|-----------|--------|------------|--------|
| | catch | ¬catch | catch | ¬catch |
| cavity | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬cavity | 0.016 | 0.064 | 0.144 | 0.576 |



$$P(\text{cavity} \wedge \text{catch}) = P(\text{'The patient visiting the doctor has cavity and catch.'}) = \\ P(\text{toothache} \wedge \text{cavity} \wedge \text{catch}) + P(\neg\text{toothache} \wedge \text{cavity} \wedge \text{catch}) = 0.108 + 0.072 = 0.18$$

Features:

| | toothache | | ¬toothache | |
|---------|-----------|--------|------------|--------|
| | catch | ¬catch | catch | ¬catch |
| cavity | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬cavity | 0.016 | 0.064 | 0.144 | 0.576 |

$$1. \quad P(\text{toothache} \wedge \text{cavity} \wedge \text{catch}) + P(\text{toothache} \wedge \text{cavity} \wedge \neg\text{catch}) + \dots \\ + P(\neg\text{toothache} \wedge \neg\text{cavity} \wedge \neg\text{catch}) = 0.108 + 0.012 + \dots + 0.576 = 1.$$

| | toothache | | ¬toothache | |
|---------|-----------|--------|------------|--------|
| | catch | ¬catch | catch | ¬catch |
| cavity | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬cavity | 0.016 | 0.064 | 0.144 | 0.576 |

$$2. \quad P(\text{toothache} \wedge \text{cavity}) = 0.108 + 0.012 = 0.12 \\ P(\text{toothache} \vee \text{cavity}) = 0.108 + 0.012 + 0.016 + 0.064 + 0.072 + 0.008 = 0.28 \\ P(\neg\text{catch}) = 0.012 + 0.064 + 0.008 + 0.576 = 0.66 \\ \dots$$

| | toothache | | ¬toothache | |
|---------|-----------|--------|------------|--------|
| | catch | ¬catch | catch | ¬catch |
| cavity | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬cavity | 0.016 | 0.064 | 0.144 | 0.576 |

3. $P(a|b) = P(a \wedge b) / P(b)$, where $P(b) > 0$.

[$P(a|b)$ – Probability of the truth of the proposition a, given the truth of the proposition b]

$$P(\text{cavity} | \text{toothache}) = P(\text{cavity} \wedge \text{toothache}) / P(\text{toothache}) = \\ (0.108+0.012) / (0.108+0.012+0.016+0.064) = 0.12/0.2 = 0.6$$

| | toothache | | ¬toothache | |
|---------|-----------|--------|------------|--------|
| | catch | ¬catch | catch | ¬catch |
| cavity | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬cavity | 0.016 | 0.064 | 0.144 | 0.576 |

4. $P(\text{toothache} \wedge \neg \text{cavity}) = 0.016 + 0.064 = 0.08$

$$P(\text{toothache} | \neg \text{catch}) = P(\text{toothache} \wedge \neg \text{catch}) / P(\neg \text{catch}) = (0.012+0.064)/0.66 = \\ 0.076/0.66 \approx 0.115$$

Homework: $P((\text{toothache} \wedge \neg \text{cavity}) | \text{catch}) = ?$

$$P(\text{catch} | (\text{toothache} \wedge \neg \text{cavity})) = ?$$

$$P(\text{catch} | (\neg \text{toothache} \vee \text{cavity})) = ?$$

...