

- **Formulas**

- Conditional Probability: $P(e \wedge h) = P(e \mid h) * P(h)$
- Bayes' Rule: $P(e \mid h) * P(h) = P(h \mid e) * P(e)$
- Chain Rule: $P(a_1 \wedge a_2 \wedge a_3) = P(a_1 \mid a_2 \wedge a_3) * P(a_2 \mid a_3) * P(a_3)$

- Filtering Formula: $P(s_i \mid o_{0..i}) = \frac{P(o_i \mid s_i) * \sum_{s_{i-1} \in S_{i-1}} P(s_i \mid s_{i-1}) * P(s_{i-1} \mid o_{0..i-1}) * P(o_{0..i-1})}{P(o_{0..i})}$
where $P(o_{0..i})$ means $P(o_0 \wedge o_1 \wedge \dots \wedge o_i)$

- **Axioms of probability**

- $P(a) \geq 0$
- $P(true) = 1$
- $P(a \wedge b) = P(a) + P(b)$ if a and b are mutually exclusive

- **Propositions**

- $P(\neg a) = 1 - P(a)$

- $P(a) = \sum_{x \in domain(X)} P(a \wedge X = x)$

- $P(a \vee b) = P(a) + P(b) - P(a \wedge b)$

- If $a \leftrightarrow b$ then $P(a) = P(b)$

- $P(a) = P(a \wedge b) + P(a \wedge \neg b) = \sum_{b \in B} P(a \wedge b)$

- **Concepts**

- Random Variables: $P(X)$ is a function from the domain of X to $[0 \dots 1]$, e.g. $P_X(32) = P(X = 32)$

- Expected Value: Let $f(w)$ be a function on worlds. Given a probability measure P , the expected value of $f \in P$ is $E_P(f) = \sum_{w \in \Omega} f(w) * P(w)$

- Expected Value Special Case:

$$f(\omega) = \begin{cases} 1 & \text{if } a \text{ is true in } \omega \\ 0 & \text{if } a \text{ is false in } \omega \end{cases}$$