• Formulas

• Conditional Probability:  $P(e \land h) = P(e \mid h) * P(h)$ 

• Bayes' Rule:  $P(e \mid h) * P(h) = P(h \mid e) * P(e)$ 

• Chain Rule:  $P(a_1 \land a_2 \land a_3) = P(a_1 \mid a_2 \land a_3) * P(a_2 \mid a_3) * P(a_3)$ 

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

• 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

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

•  $P(a) = \sum_{x \in domain(X)} P(a \land X = x)$ 

•  $P(a \lor b) = P(a) + P(b) - P(a \land b)$ 

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

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

• Concepts

• Random Variables: P(X) is a function from the domain of X to [0...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  $E_P(f) = \sum_{\omega \in \Omega} f(w) * P(w)$ 

• Expected Value Special Case:

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