$$p(A \cap B) = p(A) \cdot p(B \mid A)$$

[prob A and B] = [prob A] × [prob B given A]

$$p(A \cap B) = p(B \cap A)$$

$$\downarrow$$

$$p(B) \cdot p(A \mid B) = p(A) \cdot p(B \mid A)$$

$$\downarrow$$

$$p(A \mid B) = \frac{p(A) \cdot p(B \mid A)}{p(B)} \quad \} \; UPDATE$$

BAYE'S THEOREM

COOKIE PROBLEM   pp. 3-4

BOWL 1 B_1 BOWL 2 B_2

VANILLA   : 30   V   VANILLA   : 20   V

CHOCOLATE : 10   C   CHOCOLATE : 20   C

Σ : 40 Σ : 40

$p(B_1) = \frac{1}{2}$

$p(V \mid B_1) = \frac{30}{40} = \frac{3}{4}$ $p(V) = \frac{50}{80} = \frac{5}{8}$

POSTERIOR   PRIOR   LIKELIHOOD   P(HYPO)   P(DATA|HYPO)

$$p(B_1 \mid V) = \frac{p(B_1) \; p(V \mid B_1)}{p(V)} = \frac{\left(\frac{1}{2}\right) \cdot \left(\frac{3}{4}\right)}{\frac{5}{8}} = \frac{3}{8} \cdot \frac{8}{5} = \frac{3}{5}$$

NORMALIZING CONSTANT   UPDATE AND NORMALIZE   P(DATA)

$$= .6$$