

6.3 General Probability Rules

P(club or diamond or King of hearts)

$$P(\clubsuit) + P(\diamondsuit) + P(K\heartsuit) \\ \frac{13}{52} + \frac{13}{52} + \frac{1}{52} = \frac{27}{52}$$

P(King or heart)

$$P(K) + P(\heartsuit) - P(K\heartsuit) \\ \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52}$$

ActivStats III 14-1 Birthweights and Smoking
ActivStats III 14-1 Conditional Probability
ActivStats III 14-1 Probabilities and Tables

Definition of Conditional Probability

book

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$$

formula sheet

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

For 1 card drawn,
 $P(\text{king} | \text{red card}) =$

$$\frac{P(\text{K \& red})}{P(\text{red})} = \frac{2}{26} \quad \text{or} \quad \frac{\frac{2}{52}}{\frac{26}{52}}$$

$\frac{2}{52} \cdot \frac{52}{26}$

$$P(Q\&Q) = P(Q) \cdot P(Q|Q) \\ = \frac{4}{52} \cdot \frac{3}{51}$$

$$P(Q\&Q\&Q) = \frac{4}{52} \cdot \frac{3}{51} \cdot \frac{2}{50}$$

Tree diagrams revisited

<http://www-stat.stanford.edu/~susan/surprise/ProbabilityTree.html>



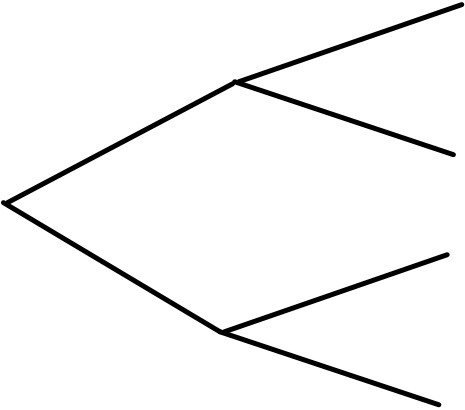
<http://www.gametheory.net/Mike/applets/Bayes/Bayes.html>



<http://www.gametheory.net/Mike/applets/Bayes/WhoReward.html>



Suppose a test for a genetic disorder is 95% accurate and that 10% of the population has the disorder. What is $P(\text{infected}|\text{positive})$?



A definition (test) for independence

Two events are independent iff $P(B|A)=P(B)$

For independent events:

$$P(A \text{ and } B) = P(A)P(B)$$

$$P(B|A) = P(B)$$

For ANY events:

$$P(A \text{ and } B) = P(A)*P(B|A)$$

A definition (test) for independence

Two events are independent iff $P(B|A)=P(B)$

Suppose I select 1 card. Are these events independent?

king
heart

$$P(K) = \frac{4}{52}$$

$$P(K|H) = \frac{1}{13}$$

=, so independent.

$$P(H) = \frac{13}{52}$$

$$P(H|K) = \frac{1}{4}$$

=, so indep

club
heart

$$P(C) = \frac{13}{52}$$

$$P(C|H) = 0$$

≠, so not
indep.

king
face card

$$P(K) = \frac{4}{52}$$

$$P(K|Face)$$

$$= \frac{4}{12}$$

≠, so not
independent