13. Bayes' Theory $p(F \mid E) = \dfrac{p(E \mid F)\, p(F)}{p(E \mid F)\, p(F) + p(E \mid \overline{F})\, p(\overline{F})}$

8% use steroids

96% test positive given use steroids

9% test positive given not use steroids

E = test positive.

F = use steroids.

p(F) =

p(E|F) = test positive given use =

$p(E \mid \overline{F})$ = test positive given not use =

p(F|E) = use steroids given test positive =

14. Expected Value

Wins $1000 if dealt 3 of a kind in poker, ignoring full house.

What is expected value of one hand?

|K3| = 3 of a kind =

|S| = # poker hands =

p(K3) = probability of winning =

E(K3) = expected value of winning

15. Expected number of heads in 2 flips?

S = ?

X(s) is number of heads

X(HH)= ?

X(HT)= ?

X(TH)= ?

X(TT)= ?

$$E(X) = \sum_{s \in S} p(s)X(s)$$

$s \in S$, X(s) = ?

$\forall s \in S$, p(s) = ?

E(X) = ?

13.

Bayes' Theory

$$p(F \mid E) = \frac{p(E \mid F)\, p(F)}{p(E \mid F)\, p(F) + p(E \mid \overline{F})\, p(\overline{F})}$$

8% use steroids
96% of users test positive
9% of non-users test positive
E = test positive.
F = use steroids.
p(F) = 8%
p(E|F) = test positive given user = 96%
$p(E \mid \overline{F})$ = test positive given not user = 9%
p(F|E) = use steroids given test positive
= .96*.08 / (.96*.08 + .09*.92)
= .481

14. Expected Value

Wins $1000 if dealt 3 of a kind in poker. Ignoring full-houses.
What is expected value of one hand?

|K3| = 3 of a kind = C(13,1)*C(4,3)*C(48,2)
C(13,1) is the 1 of 13 kinds
C(4,3) is the 3 of 4 of one kind
C(48,2) is remaining two cards, excluding the 4 of a kind.
= 13*4*1128 = 58656
|S| = poker hands = C(52,5) = 2598960

p(K3) = probability of winning = 0.022569

E(K3) = expected value of winning
= p(K3)*X(K3) = 0.022569 * $1000 = $22.57

15. Expected number of heads in 2 flips?

$$E(X) = \sum_{s \in S} p(s)X(s)$$

S = {HH,HT,TH,TT}

X(HH)=2

X(HT)=1

X(TH)=1

X(TT)=0

$s \in S$, X(s) = {2,1,1,0}, $\forall s \in S$, p(s) = ¼

E(X) = (2/4 +1/4+1/4+0/4) = 4/4 = 1