2/5/18 1

$P(A) = .01$

$P(B|A) = .9 = 1 - .1$

$P(B'|A)$

$P(A \cap B) = P(B|A)\,P(A)$

$.9 \quad .01 = .009$

$P(A' \cap B) = P(B|A')\,P(A')$

$.1 \times .99$

$= .099$

$$\boxed{P(B) = P(B|A')P(A') + P(B|A)P(A)}$$

$.1 \quad .99$

$.9 \quad .01$

$= .099 + .009$

$= .108$

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

$$P(B) = P(A \cap B) + P(A' \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{.009}{.108}$$

$\approx .1$

3

$A_1 \cup A_2 \cup A_3 = S$

$P(A_1) = .2$ $P(B|A_1) = .05$

$P(A_2) = .3$ $P(B|A_2) = .03$

$P(A_3) = .5$ $P(B|A_3) = .01$

WANT $P(A_3|B)$?

$P(B) = P(B|A_1)P(A_1) + P(B|A_2)P(A_2) + P(B|A_3)P(A_3)$

P(B) = .05 x .2 + .03 x .3 + .01 x .5 = .01 + .009 + .005 = .024

P(Band A3) = B(B|A3) P(A3) = .005

P(A3 | B) = P(B and A3) / P(B) = .005 / .024 = .2 approx

independence of 3 events
def: indep iff P(A and B and C) = P(A) P(B) P(C)

book ex 2.33, 2.32 whatever
A and B and C Prob = 0

P(A) P(B) P(C) = 1/8 != 0

big: A and B indep. A and C indep. B and C indep.
A, B and C not indep.

P(A and B) = P(A|B) P(B) = P(A) P(B) if indep

so indep -> P(A|B) = P(A)

triple indep: does this imply pairwise indep?

event: is this pixel black? $P(B) = .01$.
$P(B') = .99$

look at 2 pixels: $P(\text{exactly 0 black}) = (2 \text{ choose } 0)\ .01^0\ .99^2 = .98$
$P(\text{exactly 1 black}) = (2 \text{ choose } 1)\ .01\ .99 = .02$
$P(\text{exactly 2 black}) = (2 \text{ choose } 2)\ .01^2\ .99^0 = .0001$
$.98 + .02 + .0001 = 1$ (2 signif digits)

.)Geometric dist: repeat bernoulli trial until success.
Take a fair coin.
$P(\text{H on 1st toss}) = p = .5$
$P(\text{1st happens on 2nd toss}) = (1-p)\ p$
$P(\text{1st head happens on N-th toss}) = (1-p)^{(N-1)}\ p$
P(it will take at least N tosses)
= sum of i from N to infinity of

That has a simple formula.