STAT 381 - 13605 Quiz4 2006-9-27
Solution

1. [6pt] There are 19 marbles in a container, of which 8 are white and the rest are black.

a). One person chooses 2 of the 19 marbles at random *without replacement,* what is the probability that both marbles chosen are white?

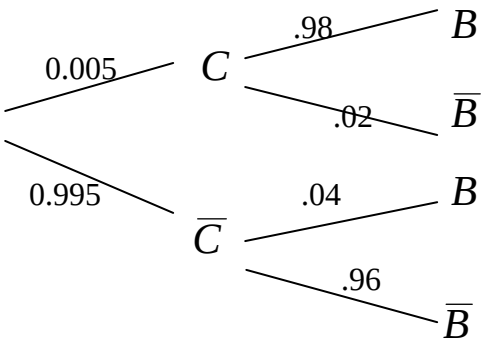
Denote A_1 = {the first marble is white}, A_2 = {the second marble is white}
then $A_1 \cap A_2$ = {both marbles are white}
Then $P(A_1 \cap A_2) = P(A_1)P(A_2|A_1) = (8/19)*(7/18) = 0.164$

b). If he chooses 2 marbles out of 19 *with replacement,* what is the probability that at least one is black?

Denote B={at least one is black}, its complement is
$\overline{B}$ ={no black}={both white}= $A_1 \cap A_2$
If he chooses the marbles ***with replacement***, that means the first draw is independent of the second draw. Then
$P(A_1 \cap A_2) = P(A_1)P(A_2) = (8/19)*(8/19) = 0.177$
Then $P(B) = 1 - P(\overline{B}) = 1 - P(A_1 \cap A_2) = 1 - 0.177 = 0.823$

2. [4pt] An airport metal detector buzzes with probability 0.98 if a person tries to carry a weapon through, and buzzes with probability 0.04 if a person does not try to carry a weapon through. Also, 0.005 of the people being scanned by the detector try to carry a weapon through. If a person makes the detector buzz, what is the probability that he is carrying a weapon?

Tree Diagram



C={carry a weapon} B={detector buzz}

C|B={the person carry a weapon if he makes the detector buzz}

P(C|B)
= P(C ∩ B) / P(B)
= (0.005*0.98)/(0.005*0.98+0.995*0.04)
=0.0049 / 0.0447
=0.1096