Section 2.4: cont'd

Wednesday, May 27, 2015
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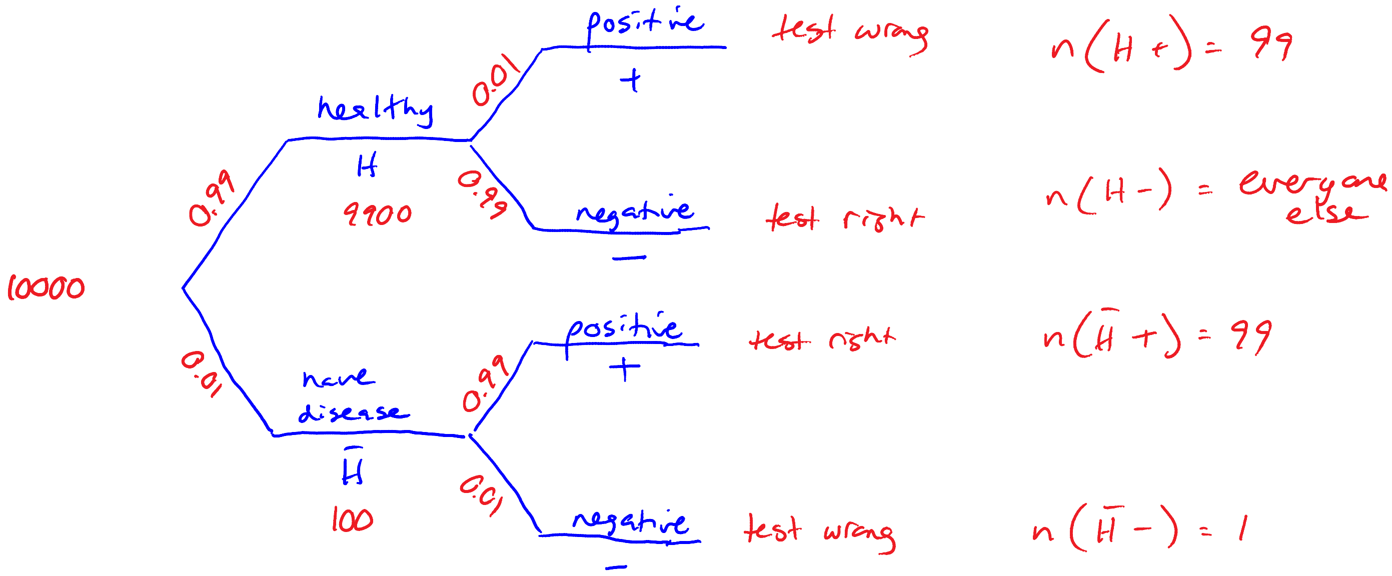
hint: if you prefer, consider the population to be 10000 individuals, and determine how many individuals fall into each group



if the individual test positive, what's the probability that they have the disease?

$$P(\bar{H} \mid +) = \frac{n(\bar{H}+)}{n(+)} = \frac{99}{99+99} = \frac{1}{2}$$

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theory (can omit!)

Bayes' theorem:

$$P(A \mid B) = \frac{P(AB)}{P(B)}$$

$$= \frac{P(B \mid A)\,P(A)}{P(B \mid A)\,P(A) + P(B \mid \bar{A})\,P(\bar{A})}$$

in general:

$$P(A_i \mid B) = \frac{P(B \mid A_i)\, P(A_i)}{\sum P(B \mid A_i)\, P(A_i)}$$

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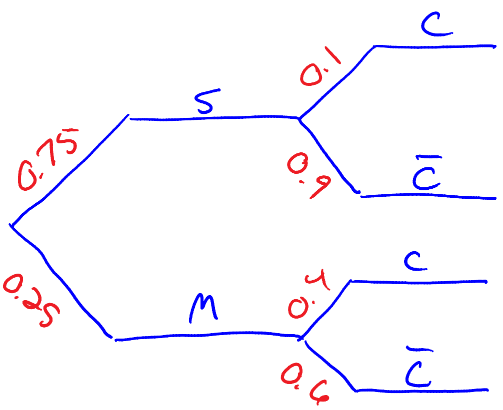
example: suppose there are only two coffee houses in Cook Street Village, Starbucks and Moka House. If Gilles goes to Starbucks, he'll order a café noir 10% of the time. At Moka House, he'll order that same drink 40% of the time. Gilles goes to Starbucks 75% of the time.

If he's ordered a café noir, what's the probability that he's at Starbucks?

given:

$P(C \mid S) = 10\%$
$P(C \mid M) = 40\%$
$P(S) = 75\%$



$P(SC) = 0.075$

$P(S\bar{C}) = 0.675$

$P(MC) = 0.1$

$P(M\bar{C}) = 0.15$

$$P(S \mid C) = \frac{P(SC)}{P(C)} = \frac{0.075}{0.075 + 0.1}$$

$$\approx 42.9\%$$

by the way, are the events "ordering a café noir" and "going to Starbuck's" independent?

$$P(C \mid S) \overset{?}{=} P(C)$$
$$0.1 \overset{?}{=} 0.175$$

conclusion : dependent