classmate
Date
Page

Bayes theorem:

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)} \quad \text{--- (i)}$$

Problem: If Disease occurs in 1% of the population.

→ If a person has D, then test will turn positive with prob $\frac{9}{10}$.

→ If a person does not have D, test will turn negative with prob $\frac{9}{10}$.

~~How many~~

∴ What is the probability that a person has a disease if it came back positive?

What I think the answer should be:

P(A) → Unconditional probability of disease.

P(B) → Unconditional probability of a positive test.

$\boxed{P(A) = \frac{1}{100}}$, $P(B) = \frac{1}{100} \times \frac{9}{10} + \frac{1}{10} \times \frac{99}{100}$

Chances of test being positive

Portion of population who has the disease

chances of test being positive

Portion of population who does not have the disease

∴ ~~$P(B) = \frac{108}{10000}$~~

∴ $\boxed{P(B) = \frac{108}{1000}}$

$P(B|A)$ = Chances of test being positive given he has a disease

$= \frac{9}{10}$ (from problem statement).

$P(A|B)$ = Chances of a person having a disease given that the test is positive.

From ~~Bayes~~ Bayes Theorem.

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

$$= \frac{\frac{9}{10} \times \frac{1}{100}}{\frac{108}{10000}}$$

$$= \frac{9}{108}$$

$= 0.083$

or

8.3%

According to the answer in class, it was slightly greater than 10%.