

## A example illustrating Bayes' Formula.

**Problem.** A laboratory blood test is 95 per cent effective in detecting a certain disease when it is, in fact, present. However, the test also yields a “false positive” result for 1 percent of the healthy persons tested. (That is, if a healthy person is tested then, with probability .01, the test result will imply he or she has the disease.) If .5 percent of the population actually has the disease, what is the probability a person has the disease given that the test result is positive?

**Solution.** Let  $D, H, P, N$  be the events that a person has the disease; that a person is healthy; that a person tests positive for the disease; that a person tests negative for the disease. We are given that

$$P(P|D) = .95, \quad P(D) = .005, \quad P(P|H) = .01$$

and are asked for

$$P(D|P).$$

By Bayes formula we have

$$\begin{aligned} P(D|P) &= \frac{P(P|D)P(D)}{P(P|D)P(D) + P(P|H)P(H)} \\ &= \frac{(.95)(.005)}{(.95)(.005) + (.01)(1 - .005)} \\ &= \frac{95}{294} \\ &\approx .323. \end{aligned}$$

So the test ain't so good, is it?