Combining Probabilities - Worked Example A new test has been developed to diagnose a particular disease. If a person has the disease, the test has a 95% chance of identifying them as having the disease.

If a person does not have the disease, the test has a 1% chance of identifying them as having the disease. 5% of the population have this disease. Suppose we select a person at random from the population.

Combining Probabilities - Worked Example Q1 - What is the probability that the test will identify them as having the disease?
Q2 - What is the probability that the person has the disease given that the test identifies them as having the disease?

Combining Probabilities - Worked Example

Solutions

- Let P signify that a test will give a positive result
- Let N signify that a test will give a negative result
- Let D signify that the person in question has the disease
- Let H signify that the person doesnt have the disease (or in other words , is healthy)

Combining Probabilities - Worked Example We are asked to determine the
following 1) The probability of a positive test - p(P) 2) The probability that
they have the disease given that they have tested positive p(D—P)

Combining Probabilities - Worked Example We are given the following three pieces of information

We know that D and H are complements, so we can work out the probabilities of these too. (P and N are complements also)

Combining Probabilities - Worked Example

People who test positive are made up of two groups

1. People who test positive and who do have the disease (P and D)

2. People who test positive and who dont have the disease (P and H)

Combining Probabilities - Worked Example
Bayes Rule is given in the Formulae
We can rearrange it as follows

Combining Probabilities - Worked Example We can now write our equation in terms of all the information we have :
ANS

Combining Probabilities - Worked Example For the second part, we simply use Bayes Rule again, using information we have determined previously ANS