**Problem**

A certain disease has an incident rate of 0.7% (i.e. probability a person is infected). A test is carried out to determine who has the disease but it is not fully accurate. If the false negative rate (i.e., probability a person tests negative but is infected) is 2.5% and the false positive rate (i.e., probability a person tests positive but is not infected) is 1.5%, give me the tens number of the probability (%) that a person who tests positive is actually infected (i.e., the accuracy of the test).

**Solution**

This exercise requires Baye’s Theorem which says that given 2 events A and B where is not A:

P(A|B) =

Adapted to our exercise we have:

P(Infected|Positive) =

We were given:

* P(Infected) = 0.7%
* P(Negative|Infected) = 2.5%
* P(Positive|Not Infected) = 1.5%

We calculate:

* P(Not infected) = 100% – P(Infected) = 100% – 0.7% = 99.3%
* P(Positive|Infected) = 100% – P(Negative|Infected) = 100% – 2.5% =97.5%
* P(Negative|Not infected) = 100% – P(Positive|Not Infected) = 100% – 1.5% = 98.5%

By plugging in the values in the Baye’s Theorem we get:

P(Infected|Positive) = = 0.31423 = 31.423%

For this probability the tens number is **3**.

**Answer: 3**

**Second solution**

Here I provided a second solution as working with numbers might be better for some people to learn. Let’s assume a population of 100000 people, although the number is irrelevant.

Let’s create a table that will help solve the excercise:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Positive test outcome | Negative test outcome |  |
| Infected | 682.5 | 17.5 | 700 |
| Not infected | 1489.5 | 97810.5 | 99300 |
|  | 2172 | 97828 |  |

The number of infected people is:

100000\*P(Infected) = 100000\*0.7% = 700

The number of people not infected is:

100000-700 = 99300

The number of infected people who test negative is:

P(Negative|Infected)\*700 = 2.5%\*700 = 17.5

Do not stumble because you can’t have 17.5 people in reality. You only care about the corectness of your calculations.

The number of infected people who tested positive is:

700 – 17.5 = 682.5

The number of people who are not infected but test positive is:

P(Positive|Not infected)\*99300 = 1.5%\*99300 = 1489.5

The number of people who are not infected and test negative is:

99300 - 1489.5 = 97810.5

We can now calculate how many people test positive and how many negative:

Number of people who tested positive = 682.5 + 1489.5 = 2172

Number of people who tested negative = 17.5 + 97810.5 = 97828

So the probability that an infected person tests positive is:

P(Infected|Positive) = = = 0.31423 = 31.423%

For this probability the tens number is **3**.

**Answer: 3**