

Answer on Question #47265 – Math – Statistics and Probability

A new analytical method to detect pollutants in water is being tested. Instead of having to use a single test for each pollutant. The makers of the test claim that it can detect high levels of organic pollutants with 99.6% accuracy, volatile solvents with 99.94% accuracy, and chlorinated compounds with 89.8% accuracy. If a pollutant is not present, the test does not signal. Samples are prepared for the calibration of the test and 60% of them are contaminated with organic pollutants, 27% with volatile solvents, and 13% with traces of chlorinated compounds. A test sample is selected randomly.

(a) What is the probability that the test will signal?

Solution

Let O be "water with organic pollutants is selected", V be "water with volatile solvents is selected", C be "water with chlorinated compounds is selected", D be "pollutant is detected".

The given data is

$$P(O) = 0.60; P(V) = 0.27; P(C) = 0.13; P(D|O) = 0.996; P(D|V) = 0.9994; P(D|C) = 0.897.$$

In our notation, the probability that the test will signal is

$$P(D) = P(D|O)P(O) + P(D|V)P(V) + P(D|C)P(C).$$

$$P(D) = 0.996 \cdot 0.60 + 0.9994 \cdot 0.27 + 0.898 \cdot 0.13 = 0.9842.$$

Answer: 0.9842.