EXAM OF STATISTICS
(PROBABILITY AND RANDOM VARIABLES)

Pharmacy/Biotechnology 1st year — Version B — **January 17, 2022**

Duration: 1 hour.

(3 pts.) 1. A diagnostic test for a disease with a prevalence of 10% has a positive predictive value of 40% and negative predictive value of 95%.

(a) Compute the sensitivity and the specificity of the test.

(b) Compute the probability of a right diagnose.

(c) What must be the minimum sensitivity of the test to be able to diagnose the disease?

Solution

(2 pts.) 2. To study the effectiveness of two antigen tests for the COVID both tests have been applied to a sample of 100 persons. The table below shows the results:

Test A	Test B	Num persons
$+$	$+$	8
$+$	$-$	2
$-$	$+$	3
$-$	$-$	87

Define the following events and compute its probabilities:

(a) Get a $+$ in the test A.

(b) Get a $+$ in the test A and a $-$ in the test B.

(c) Get a $+$ in some of the two tests.

(d) Get different results in the two tests.

(e) Get the same result in the two tests.

(f) Get a $+$ in the test B if we got a $+$ in the test A.

Are the outcomes of the two tests independent?

Solution

(5 pts.) 3. It is known that the life of a battery for a peacemaker follows a normal distribution. It has been observed that 20% of the batteries last more than 15 years, while 10% last less than 12 years.

(a) Compute the mean and the standard deviation of the battery life.
Remark: If you are not able to compute the mean and the standard deviation, use a mean of 14 years and a standard deviation of 1.5 years for the following parts.

(b) Compute the fourth decile of the battery life.

(c) If we take a sample of 5 batteries, what is the probability that more than half of them last between 13 and 14 years?

(d) If we take a sample of 100 batteries, what is the probability that some of them last less than 11 years?

Solution
