EXAM OF STATISTICS
(PROBABILITY AND RANDOM VARIABLES)

2nd Physiotherapy   Version A   **June, 29 2021**

Duration: 1 hour.

(2.5 pts.) 1. Let A and B be two events of a same sample space, such that $P(A) = 3/8$, $P(B) = 1/2$ and $P(A \cap B) = 1/4$. Compute the following probabilities:

    (a) $P(A \cup B)$.

    (b) $P(\overline{A})$ and $P(\overline{B})$.

    (c) $P(\overline{A} \cap \overline{B})$.

    (d) $P(A \cap \overline{B})$.

    (e) $P(A|B)$.

    (f) $P(A|\overline{B})$.

    (g) Are A and B compatible? Are A and B dependent?

Solution

(4 pts.) 2. A blood analysis detects a disease in 94% of cases when the disease exists. However, the test produce a false positive in 6% of the patients. We also know that 10% of the population suffer the disease.

    (a) What is the probability that a random person has the disease if the outcome of the test is positive? Would you diagnose the disease with that probability?

    (b) Compute the negative predictive value and interpret it. Is this test better to confirm or to rule out the disease?

    (c) Compute the probability of a wrong diagnostic.

    (d) If we pick a sample of 11 patients from this population, what is the probability of a wrong diagnostic in more than 2 patients?
    Remark: Use 0.1 as the probability of a wrong diagnostic if you do not know how to compute it.

Solution

(3.5 pts.) 3. The thoracic perimeter of a male population of ages between 25 and 40 follows a normal distribution of mean 102 cm. It is also known that 20% of the population have a perimeter above 111 cm.

    (a) Compute the standard deviation of the thoracic perimeter.
    Remark: If you do not know how to compute it, use a standard deviation of 9.5 cm for the next parts.

    (b) Compute the interquartile range of the thoracic perimeter distribution.

    (c) What is the probability that in a sample of 100 males from this population, there are at most 3 with a thoracic perimeter less than 82 cm?

Solution