

True/False - No explanation needed. (1pt for correct, 0pt - no answer, -1pt - incorrect)

1. It is sufficient to conclude that the event A is independent from the event B if $P(B) = P(A|B)$. True/False
False. Should be $P(B) = P(B|A)$
2. If two events A and B are independent. It is guaranteed that $P(A \cap B) = P(A)P(B)$. True/False
True. This is one definition of independence.

Problems - Need justification. No justification means **zero**!

1. (10pts) Suppose a new cancer test has a 90% chance of correctly identifying that a sick patient has cancer and a 15% chance of incorrectly identifying that a healthy patient has cancer. Assume that 10% of the population has this form of cancer. Compute the following probabilities:
 - a) The probability that the test identifies a randomly chosen person as having cancer.
 - b) The probability that a person who tests positive for cancer actually has cancer.

A: having cancer, B: test positive.

$$P(B|A) = 0.9, P(B|\bar{A}) = 0.15, P(A) = 0.1$$

(a)

$$\begin{aligned} P(B) &= P(B \cap A) + P(B \cap \bar{A}) \\ &= P(B|A) * P(A) + P(B|\bar{A}) * P(\bar{A}) = 0.9 * 0.1 + 0.15 * 0.9 = 0.225 \end{aligned}$$

(b)

$$P(A|B) = \frac{P(B|A) * P(A)}{P(B)} = \frac{0.9 * 0.1}{0.225} = 0.4$$