

Introductory Quiz

SURNAME: FIRST NAME: SECTION:

1. Let P be a probability and A, B be two events. Among the following identities, which are always true?

- a) $P(A \cup B) = P(A) + P(B)$. b) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
 c) $P(A|B) = \frac{P(A \cap B)}{P(B)}$, if $P(B) \neq 0$. d) $P(A \cap B) = P(A) \cdot P(B)$.

2. Gaussian random variables

- a) Let X be a random variable such that $P(X \geq 0) = 1$. Can X be a Gaussian random variable?
 b) Let Y be a Gaussian random variable with mean μ . Is it true that $P(Y \geq \mu) = 1/2$?
 c) Let Z be a random variable such that $P(Z = 1) = 1/2$. Can Z be a Gaussian random variable?

3. You throw a (fair) coin 1000 times. What is the probability that you end up with exactly 500 tails and 500 heads?

- a) $1/2$ b) 0 c) approximately 0.025

4. Name three scientists whose names are associated to distributions of random variables.

- a) b) c)

5. Let X be a random variable such that $P(X = 1) = P(X = 0) = 1/2$.

- a) What is the mean of X ? b) What is variance of X ?

Let now Y be the random variable defined as $Y = 2X - 1$.

- c) What is the mean of Y ? d) What is variance of Y ?

6. Which of the following statements is true?

- a) If $\text{Cov}(X, Y) = 0$, then X and Y are independent.
 b) If X and Y are independent, then $\text{Cov}(X, Y) = 0$.
 c) X and Y are independent if and only if $\text{Cov}(X, Y) = 0$.

7. Subsidiary question: give the definition of convergence in probability:

$X_n \xrightarrow{P} X$ means