

Foundations of Probability¹

STA 256: Fall 2018

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The idea

Informally, a probability is a number between zero and one indicating how likely an event is to occur.

Axioms of Probability

Kolmogorov (1933)

A probability measure is a function P from subsets of Ω to the real numbers, satisfying

- 1 $P(\Omega) = 1$
- 2 $P(A) \geq 0$ for any $A \subset \Omega$
- 3 If $A_i \cap A_j = \emptyset$ for A_1, A_2, \dots , where $i \neq j$,
$$P\left(\bigcup_{k=1}^{\infty} A_k\right) = \sum_{k=1}^{\infty} P(A_k)$$

Properties of Probability

- A. $P(A^c) = 1 - P(A)$
- B. $P(\emptyset) = 0$
- C. If $A \subseteq B$ then $P(A) \leq P(B)$
- D. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (The addition law)

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<http://www.utstat.toronto.edu/~brunner/oldclass/256f18>