Class Notes| Lecture 1

MSO: Introduction to Probability Theory

Fall 2024

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Note 1. Definition 1 (Random Experiment): An experiment in which:

- all possible outcomes of the experiment are known in advance
- outcome of a particular trial/performance of the experiment cannot be specified in advanced
- the experiment can be repreated under identical conditions

Denoted via ε

Note 2. Definition 2 (Sample Space): THe collection of all possible outcomes of the random experiment ε is called its sample space. Example:

$$\omega = (x, y, z) : x, y, z \in H, T$$

Note 3. Definition 3 (Events): If the outcome of a random experiment ε is an element of a subset $\mathscr{E}$ of ω, then we say that the event $\mathscr{E}$ has occured. An event is an set object.

Collection of all events is denoted as $\mathscr{F}$. This means $\mathscr{F}$ is a set of sets. Empty Set $\emptyset$ and the sample space Ω will always be an element in F.

Note 4. Definition 4 (Probability, Classical (A priori) Definition): Suppose that a random experiment results in n (a finite number) outcomes. Given an event $mathscrA \in \mathscr{F}$, if it apears in m ($0 \leq m \leq n$) outcomes, then the probability of $\mathscr{A}$ is $\frac{m}{n}$.

The classical definition only works when there are finitely many outcomes. Due to the limitations of this definition, we look for other ways to understand the notion of probability.

Note 5. Definition 5 (Probability, Relative Frequency(A posteriori) Definition): If a random experiment $\mathscr{E}$ is repeared a large number, say n, of times and an event $\mathscr{A}$ occurs m many times, then the relative frequency $\frac{m}{n}$ may be taken as an approximate value of a probability of $\mathscr{A}$.