Nachrichtentechnik 2

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Contents

1 Probability and Random Variables

Definition 1 (Random experiment)**.** The experiment is called *random* if its outcome cannot be predicted.

Definition 2 (Sample space and events)**.** The set of all possible outcomes of a random experiment is called the *sample space* S. An $\lambda \in S$ is called a *sample point*. A set of sample points $A \subset S$ is called an *event*.

Definition 3 (Auxiliary definitions)**.** The *complement* of an event A is $\overline{A} = \{\lambda \in S : \lambda \notin A\}$. The *union* of two events A and B is $A \cup B = \{\lambda \in S : \lambda \in A \vee \lambda \in B\}$, similarly the *intersection* is $A \cap B = \{\lambda \in S : \lambda \in A \wedge \lambda \in B\}$.

2 Random Processes

Previously we defined a random variable as a function $X : S \to E \subset \mathbb{R}$ that assigns a *number* to each event. We will now extend this concept.

Definition 4 (Random Process)**.** For a random experiment with sample space S, we assign to every event $\lambda \in S$ a *function* of time. The *random process* $X(t, \lambda)$ is effectively $X : \mathbb{R} \times S \to E \subset \mathbb{R}$.

Remark 1. Notice that for a fixed λ_i, $X(t, \lambda_i) = X(t)$ is indeed a function of time. Conversely for a fixed time t_i, $X(t_i, \lambda)$ is a a random variable. Only when both a λ_i and t_i are given $X(t_i, \lambda_i)$ is a number.

Definition 5 (Distribution)**.**