6.2.0 Probability Bounds

In this section, we will discuss probability bounds. These are inequalities that are usually applicable to a general scenario. There are several scenarios in which we resort to inequalities. Sometimes we do not have enough information to calculate a desired quantity (such as the probability of an event or the expected value of a random variable). In other situations, the problem might be complicated and exact calculation might be very difficult. In other scenarios, we might want to provide a result that is general and applicable to wide range of problems.

For example, suppose that you are an engineer and you design a communication system. Your company wants to ensure that the error probability in your system be less than a given value, say 10^{-5}. Calculating the exact value of probability might be difficult due to some unknown parameters or simply because the communication system is a complicated one. Here you do not actually need to find the error probability exactly, but all you need to do is to show that it is less than 10^{-5}.

In this section, we will discuss several inequalities. Depending on the problem you are dealing with, you might decide which one to use.