

1.4: Continuous Probability Distributions

Suppose that the variable u can take on a continuous range of possible values. In general, we expect the probability that u takes on a value in the range u to $u + du$ to be directly proportional to du , in the limit that $du \rightarrow 0$. In other words,

$$P(u \in u : u + du) = P(u) du, \quad (1.4.1)$$

where $P(u)$ is known as the *probability density*. The earlier results (1.2.4), (1.3.4), and (1.3.11) generalize in a straightforward manner to give:

$$\begin{aligned} 1 &= \int_{-\infty}^{\infty} P(u) du, \\ \langle u \rangle &= \int_{-\infty}^{\infty} P(u) u du, \\ \langle (\Delta u)^2 \rangle &= \int_{-\infty}^{\infty} P(u) (u - \langle u \rangle)^2 du = \langle u^2 \rangle - \langle u \rangle^2, \end{aligned}$$

respectively.

Contributors and Attributions

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