

- A real r.v. X with cumulative distribution function $F_X(x) = \Pr\{X \leq x\}$ (CDF) is
 - **discrete** if $F_X(x)$ increases only at a countable number of values of x ;
 - **continuous** if $F_X(x)$ is continuous, or equivalently, $\Pr\{X = x\} = 0$ for every value of x ;
 - **mixed** if $F_X(x)$ is neither discrete nor continuous.
- \mathcal{S}_X is the set of all x such that $F_X(x) > F_X(x - \epsilon)$ for all $\epsilon > 0$.

$$Eg(X) = \int_{\mathcal{S}_X} g(x) dF_X(x),$$

where the right hand side is a **Lebesgue-Stieltjes integration** which covers all cases (i.e., discrete, continuous, and mixed) for the CDF $F_X(x)$.