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mode

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Given a probability distribution (density) function $f_X(x)$ with random variable X and $x \in \mathbb{R}$, a *mode* of $f_X(x)$ is a real number α such that:

1. $f_X(\alpha) \neq \min(f_X(x))$,
2. $f_X(\alpha) \geq f_X(z)$ for all $z \in \mathbb{R}$.

The mode of f_X is the set of all modes of f_X (It is also customary to say denote the mode of f_X to be elements within the mode of f_X). If the mode contains one element, then we say that f_X is *unimodal*. If it has two elements, then f_X is called *bimodal*. When f_X has more than two modes, it is called *multimodal*.

- if $\Omega = \{0, 1, 2, 2, 3, 4, 4, 4, 5, 5, 6, 7, 8\}$ is the sample space for the random variable X, then the mode of the distribution function f_X is 4.
- if $\Omega = \{0, 2, 4, 5, 6, 6, 7, 9, 11, 11, 14, 18\}$ is the sample space for X, then the modes of f_X are 6 and 11 and f_X is bimodal.
- For a binomial distribution with mean np and variance $np(1-p)$, the mode is
$$\{\alpha \mid p(n+1) - 1 \leq \alpha \leq p(n+1)\}.$$
- For a Poisson distribution with integral sample space and mean λ, if λ is non-integral, then the mode is the largest integer less than or equal to λ; if λ is an integer, then both λ and $\lambda - 1$ are modes.
- For a normal distribution with mean μ and standard deviation σ, the mode is μ.
- For a gamma distribution with the shape parameter γ, location parameter μ, and scale parameter β, the mode is $\gamma - 1$ if $\gamma > 1$.
- Both the Pareto and the exponential distributions have mode $= 0$.