Probability Distribution

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Distribution Name	LaTeX Formula	Real-Life Example
Continuous Distributions		
Normal (Gaussian)	$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$	Heights of individuals in a population
Uniform	$f(x) = \frac{1}{b-a}$	Random numbers between a and b
Exponential	$f(x) = \lambda e^{-\lambda x}$	Time between arrivals in a Poisson process
Chi-Squared	$f(x) = \frac{1}{2^{\frac{k}{2}}\Gamma\left(\frac{k}{2}\right)} x^{\frac{k}{2}-1} e^{-\frac{x}{2}}$	Testing goodness of fit, error analysis
Cauchy	$f(x) = \frac{1}{\pi(1+x^2)}$	Electrical conductivity in physics experiments
Log-Normal	$f(x) = \frac{1}{x\sigma\sqrt{2\pi}} e^{-\frac{(\ln(x)-\mu)^2}{2\sigma^2}}$	Stock prices, income distribution
Gamma	$f(x) = \frac{1}{\Gamma(k)\theta^k} x^{k-1} e^{-x/\theta}$	Waiting times, reliability analysis
Weibull	$f(x) = \frac{k}{\lambda} \left(\frac{x}{\lambda}\right)^{k-1} e^{-(x/\lambda)^k}$	Failure times of mechanical components
Beta	$f(x) = \frac{1}{B(\alpha,\beta)} x^{\alpha-1}(1-x)^{\beta-1}$	Probability of success in binomial distribution
Triangular	$f(x) = \begin{cases} \frac{2(x-a)}{(b-a)(c-a)} & \text{if } a \leq x \leq c \\ \frac{2(b-x)}{(b-a)(b-c)} & \text{if } c \leq x \leq b \\ 0 & \text{otherwise} \end{cases}$	Estimating uncertainty in project durations
Discrete Distributions		
Binomial	$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$	Number of successes in a fixed number of trials
Poisson	$P(X = k) = \frac{e^{-\lambda}\lambda^k}{k!}$	Number of events in a fixed interval of time
Geometric	$P(X = k) = (1-p)^{k-1} p$	Number of trials needed for the first success
Bernoulli	$P(X = x) = \begin{cases} p & \text{if } x = 1 \\ 1-p & \text{if } x = 0 \end{cases}$	Success/failure in a single trial
Hypergeometric	$P(X = k) = \frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}$	Defective items in a sample without replacement