Note

Discrete random variable	Continuous random variable
• $P(X \le k) = \sum_{i=0}^{k} P(X = i)$ • $P(X > k) = 1 - P(X \le k) = 1 - \sum_{i=0}^{k} P(X = i)$ • $P(k_1 < X \le k_2) = \sum_{i=k_1+1}^{k_2} P(X = i)$	• $P(X < x) = F(x)$ • $P(X \ge x) = 1 - P(X < x) = 1 - F(x)$ • $P(x_1 \le X < x_2) = P(X < x_2) - P(X < x_1)$

Python statements

Distribution	Parameters	Question	Python statements
Binomial distribution $P(X = k) = \frac{n!}{(n-k)!\,k!} p^k (1-p)^{n-k}$	• n: identical trials • p: probability of a success, denoted by p	Given k, to find $P(X = k)$	from scipy.stats import binom binom.pmf(k, n, p)
		Given k, to find $P(X \le k)$	from scipy.stats import binom binom.cdf(k, n, p)
Poisson distribution $P(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}$	• λ: mean value of events in an interval	Given x, to find $P(X = k)$	from scipy.stats import poisson poisson.pmf(k, λ)
		Given x, to find $P(X \le k)$	from scipy.stats import poisson poisson.cdf(k,λ)
Normal distribution • $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ • $F(x) = \int_{-\infty}^{x} f(y)dy$	• μ: mean value • σ: standard deviation	Given x, to find $P(X < x)$	from scipy.stats import norm norm.cdf(x,loc=μ,scale=σ)
		Given x, to find $P(X > x)$	from scipy.stats import norm 1− norm.cdf(x,loc=μ,scale=σ)
		Given x_1 and x_2, to find $P(x_1 < X < x_2)$	from scipy.stats import norm norm.cdf(x_2,loc=μ,scale=σ) $-$norm.cdf(x_1, loc $= \mu$, scale $= \sigma$)
		Given $p = P(X < x)$, to find x	from scipy.stats import norm norm.ppf(p,loc=μ,scale=σ)
Exponential distribution $F(x) = 1 - e^{-\lambda x}$	• λ: mean value of the interval	Given x, to find $P(X < x)$	from scipy.stats import expon expon.cdf(x, 0, λ)
		Given $p = P(X < x)$, to find x	from scipy.stats import expon expon.ppf(p, 0, λ)

- **Please note: in the discrete probability distributions (Binomial and Poisson), $P(X \le k)$ includes the "equal" symbol, which differs from those in the continuous probability distributions.**